MARTY ROSENBERG
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STEPHEN WALLs INTERVIEW

Hi, welcome to GridTalk. Today we have with us, Stephen Walls, who's the deputy chief energy officer of the Hawaii State Energy Office (HSEO).

Q: Hi, Stephen. Thanks for joining us.

A: Hi, Marty. Glad to be here.

Q: Lot to talk about; I'd like to jump in and ask you about the news that everybody's focused on, the destructive fires that have taken place in Maui. It's early on really and not a lot of study can be done but what has your office doing in terms of meshing what can be learned from this experience with the state energy policies looking forward?

A: Well, thank you Marty for, yeah, I just want to acknowledge the significant loss of life and property and the devastation that people are going through right now. The Energy Office and state generally are still in response mode so we're not yet fully pivoted into immediate and long-term planning and so in response mode, we're still looking into at what happened and in hopefully we'll know more soon and all that information will be public in

due time. For the State Energy Office, the way that we participate in emergency response is under a framework developed and implemented by the Federal Energy Management Agency or FEMA and as an emergency support function in the National Disaster Response Framework so there's a lot of buzzwords there but it's essentially FEMA has this overall framework and the different subject matter experts and different agencies participate. Energy is 12 so when there is an activation, state officials go to an Emergency Operations Center. Different specialties get called in at different times and as the Energy Office, we are the energy experts so we participate as emergency support function as well. We have different staff here that rotate through. They're…for a long time…in the immediate leading up to an aftermath of an event, staff is there 24/7. Right now, we're still staffing the Emergency Operations Center but it's not at 24-hour shift any more, which is so some of the staff is catching up on sleep, which is great. And this overall Framework through the EOC provides a mechanism of coordination and so the federal officials all gather in the DC and FEMA headquarters. There's also a regional response center that other federal officials go to. There's the State EOC where state officials go and then there's the county and municipal level centers where county and municipal officials go and so that provides a central place where we're all

next to each other and can coordinate, communicate effectively, and make sure our resources get to where they need to go and that's where a lot of our overall work is.

Q: So, Stephen, let's see if we can tease out some themes here though. Earlier reports are that some of the fires at least may have been started by electric lines that were downed and very significant winds. And whether that's fully known or the extent that contributed to the problem, put that aside for a second and let's talk about the state's plan to have 100% renewable energy by 2045. Would that kind of scenario mean there would be less reliance on these lines that could be sparking and causing fires as the grid gets more distributed?

A: Well, there's a lot of…there are a few different ways that this could play out and independent of anything that happened in Maui, to reach the state's goal in 2045 there are a few different pathways. I think it's safe to say that in the last 5 to 10 years of that period so from 2035 and on, what technology makes the most sense, what's available, what's economical, is yet to be determined, right, so we don't know exactly what that last phase is going to be. From today looking out trying to predict out that far, there's been a strong push across the state to pursue distributed energy resources and one of the key elements of that is making sure the grid is stable and available and we can talk

more about inverter-based resources, actually, I would love to do that. But there's still some concern about availability of distributed energy resources particularly and even utility-scale resources that are based on the availability of wind and sun. Right now, well the office is going through an exercise of trying to think through and identify what resources the state does have, to make sure that the energy system remains available, even in during strange or extreme weather events. Some of those resources will rely on transmission which means that the distribution grid is still there but there's also on the other end of the extremes if the technology makes sense to be extremely highly distributed then you potentially mitigate the need for some transmission. But I haven't seen anything yet that would lead me to believe that each building would be its own island and that there would be no need for distribution lines so I'm not really sure that that hypothetical is where we're going to head.

Q: So, just top of mind here, has power been largely restored to Maui or is there still pockets of blackouts?

A: I believe the latest figures are in the upper 90's percent restored.

Q: Ninety percent?

A: Yeah, so there's still the long tail is not yet fully; we haven't chased all of it down yet.

Q: As you and I chatted in preparation for this podcast, we talked about the availability of geothermal on the Big Island, hydro and possible development of pump storage resources. Give us a sense of the diversity of resources Hawaii is looking at.

A: Yeah, so we have, we know there's good geothermal on Big Island. We would like to explore other geothermal resources statewide so we're looking at different islands just to see what resources we have. And in looking for differences resources, we can find fresh water. We might find cold water. We might find hot water. We also may find places to sequester carbon. As some of your listeners might know, our goal in 2045 is to achieve net negative emissions economy-wide and so part of that future could very well be carbon sequestration and by doing exploration for water resources for identifying what's under the surface, we also might find really good places to put carbon. We also are considering what options we have for long-duration storage and pumped storage hydroelectric power is by far is the most common long-duration storage today. It typically involves some elevation gain and pumping water when there's excess electricity uphill and then using it flowing downhill and when you need it. There are a couple of promising areas across the state where pumped storage hydro would make sense. There's a project being pursued on Kauai

right now but we need to find a couple of other suitable locations for that long duration storage to make sense.

Q: So, Hawaii has really led the way on rooftop solar and maybe you have some of the stats you can share with us. I wonder if you could talk a little bit about Hawaii is really not a large state either geographically; population-wise your 1.5 million ranks I think 40th among states. To what extent to you and other energy policy thinkers and we'll get to the fact or I'll bring it up now that I think you've worked at DoE, you've worked for NRDC. To what extent is Hawaii a possible testbed of things that will be tried out and modeled for the rest of the country?

A: I think the state has a pretty strong track record in that regard especially with regard to distributed solar and hopefully we can continue some of that success. I know when I was at the Department of Energy, the Energy Systems Integration Facility just got launched at the National Renewal Energy Lab and one of their first big results was in Hawaii and cooperative research done between NREL, the utility here Hawaiian Electric, the main utility investor here Hawaiian Electric, and I believe it was Solar City at the time, looking into this question of how much solar could go on to a distribution feeder and would it be safe? Up until that point, the default limit was 10% of daytime minimum load and the results that were coming back were enabled to peak

load to have the highest distribution of PV on its feeders compared to daytime minimum load, I think that the world have ever seen at that point, I think some of them continued to lead in that regard.

Q: What's the percentage?

A: I think some of them were well, like pushing 250% of daytime minimum load now.

Q: Wow, okay.

A: Yeah, whereas the default standard back when all of these questions were being asked across the state was 10%, so we kind of blew right past that and hopefully advanced the conversation nationwide about the safety of integrating these kinds of resources onto the grid.

Q: So, have new technologies been developed? Does the state have to develop new policies and new tariffs to help this grow?

A: Yes, definitely. I think one of the key technologies for the state has been smart inverters and 10 years ago, most inverters were one-way communication. They just made…they had whatever distributed resource that was feeding onto the grid follow grid conditions and so most of your distributed PV across the country is on what we may be unfairly referred to as a 'dumb inverter,' and it can only really do one thing and it supplies power within certain parameters to the distribution system. Smart inverters

where Hawaii and California have really taken the lead can do a whole lot more and provide a bunch of different grid services to help that enable those distributed resources to add system stability rather than rely on other assets to provide stability so that, which is really important as you start to see the kind of penetration levels of distributed PV in particular here in Hawaii, the inverters need to play really nicely with the existing distribution system controls and even provide some visibility to the utility central location so they can keep the system running the way it's supposed to. And having smart inverters with good controls enables the distributed systems to play a key role in keeping the lights on.

Q: So, let's get back to for a second to what you said earlier about net negative carbon emissions and you're achieving that through agricultural practice reforms. It wasn't long ago I was in the Netherlands trying to get to the Amsterdam airport and farmers were converging on it with their tractors because they were upset with the EU energy policy was forcing them to be more rational in carbon emissions. How do you hope to get negative emissions from your farm sector in Hawaii and do you have a model for bringing the farm sector along instead of making enemies of them?

A: On, I think there are still some key lessons for us all to learn on how food and energy can have a synergy and help each other rather than be at odds and the state has some food security goals. As you might know we import the vast majority of the food that we eat and there is some momentum here to increase the amount of food production and that means shifting former plantation lands that grew commodity crops like pineapples into making food for local consumption and there's, sometimes there's a perceived tension for using land for agricultural purposes and using land for energy whether it's biofuels or putting windfarms up or solar farms. One of our key questions that's before us now is trying to think through is how can renewable resources and agricultural production play really nicely on the same parcel of land? And we have…there's a pilot project that the Hawaii Agricultural Center is kind of wrapping up showing how different crops perform on an existing solar farm, build to spec without any sort of consideration for agricultural production just, what works with that sort of setup and so the next set of questions is going to be, are there slight modifications we can make to add to PV racking and inspects and heights and so on in order for agricultural production to have a stronger role in the use of the parcel so that we can get a twofer out of every piece of good agricultural land; we get both food production and PV?

Q: So, if I get this right, you'll have a solar farm with PV and interspaced with that, you'll have crops growing?

A: That's the goal, yes, and we've seen a pilot do that pretty successfully with some crops just down the road from where I am now.

Q: What kind of crops?

A: They had something call Ti Leaves; it makes Ti, not tea but Ti. The kale looked really good. They were starting to put mushrooms, mushroom logs up underneath the panels because it's shaded all of the day and it stays nice and moist there. The kale looks really good, like I wanted to take some of the kale home and make a salad with it. They put in some sweet potatoes and it will be interesting to see how the sweet potatoes go because the farmers out there when you dig up the sweet potatoes, it's hard to do if you can't get your tractor through the row, so that's I think going to be one of the more interesting crops that we see the results from the experiment.

Q: So, is this potentially a large-scale agriculture or is it just like a kitchen garden?

A: The goal is to have it be large-scale. It won't be like a large Midwestern farm with huge agricultural equipment but it would still be a large commercial enterprise. That's the goal and one of the key questions is how to space the racking and the

height of those systems in order to accommodate both the PV, the cost of the solar farm and the ability of the farm to have mechanized elements of its production so we're trying to figure out that balance right now and hopefully it will a contribution to *"agri-voltaics"* going forward and I think that it's one of the…for the state, seeing synergy between the food security and energy security goals I think is definitely important and hopefully we get some good results out of this project.

Q: So, I think you just coined a new word; at least I have not heard it before *"agri-voltaics."*

A: Oh it's…I can't claim credit for that one unfortunately.

Q: I want to ask you a little bit about the ambition of being 100% renewable by 2045. A lot of states have something like that on the books and a lot of states are working in that direction and as you alluded to earlier, Hawaii has had early successes in getting major penetration of rooftop solar out into the cities and, but one recent stat I saw that while you won't be 100% by 2045, in one recent year about 29% of the state's energy production was considered renewable. Is that still accurate? Is it about a third?

A: Yeah, if you look statewide, it's about a third. Each island has its own energy system. There are no interisland cables so some islands like Kauai are much higher. But if you look

statewide, the average is always heavily weighted towards the proportion of renewables on Oahu where the most people are.

Q: So, if a state like Hawaii which has been aggressively on this track for a couple of decades is still at 29%-30%, how do you in a mere two decades, how do you get to 100%? What's your vision on how to get that kind of scale?

A: Yeah, I mean that's the million-dollar question, right? I think we're encouraged by a few things. One, Kauai is over half of its energy supplied is renewable and if they are able to complete their pump storage hydro project, then they'll be pushing over 70 and they'll still have the rest of the time to figure out how much more…what else they should do. But a big piece of closing the gap is finding good resources. There's only so much land for solar. There's only so much land for wind. What else can we bring to the table? There are offshore resources that have…there's a mixed bag there but we could potentially do some biofuels but I think one of the big questions that we should answer is where there are good water resources and potentially some places to sequester carbon. So, as you to get to net negative, we want to be as efficient as possible. We want to be… switch as much as we can to renewable electricity and renewable fuels, but there will be some very hard to decarbonize elements and we're going… sequestration could be an important strategy in

reaching that negative and so if we can understand better what our resources are with regard to the water, geothermal and carbon sequestration we could end up getting some really good news and then it puts 100% well within reach.

Q: So, the good news will be on the sequestration front or where would it be?

A: Essentially. It could also be geothermal.

Q: So, on sequestration, it's been kicked around by DoE and others for a long time now. It is implicit now that you'll continue to burn natural gas and coal as some percentage of your need and that's how you will deal with the carbon?

A: Well, our last coal plant shut down but we are; it's mostly low sulphur fuel oils and we do not currently have natural gas power for supply but there is natural gas supplied for building and functions and some industrial use. If we…in order to…by the time we… get into the 2040s there might not be a good alternative to fuel combustion for some things. And if we can't decarbonize everything then we'll have to sequester.

Q: Okay and we haven't talked really about electrification of transport and other aspects of society. You talked about several islands. We haven't talked about Oahu which is your main, most populated island is it not? And what's the energy picture there?

A: Yes, Oahu is our most populated island there's a lot of distributed solar here, there's some utility scale solar here and some utility scale wind, but this was where the coal plant was and it recently shut down and is being replaced by a 185 megawatt for our battery storage facility that is capable of doing providing grid services including black start and that's slated to be fully operational by the end of the year. The central stations, the thermal generation is low sulphur fuel oil.

Q: Okay. And what about water resources? You said you were looking at developing water resources. How does that affect the energy picture?

A: Well, we could find some hot water which would be good for geothermal. We could find water for biofuels. We could also find good…it's less important; it's less of impact of, ground water has less of a role but it could be a piece of storage hydro as well.

Q: Okay. Looking to the future, I mean you've looked at energy policy in the United States and now you're looking at it up close in Hawaii. Are you optimistic that there's going to be a major transformation by 2045 and will Hawaii be in the front ranks of those achieving it?

A: Yes, to both questions, to both parts of the question. I think Hawaii set the country's most ambitious goals back in 2008

in setting a 70% clean energy target and a few years ago we were the first state to set a 100% net negative goal by 2045. We've led with the use of and reliance on distributed energy renewable resources and will continue to do that and be at one of the leading voices in smart inverters and inverter-based resources in providing grid services there. You know, there's a lot of work to do, there's no question about that, but in looking back when the state started on this journey from where we are now there are a lot of big questions around the safety of certain renewable resources, their ability to the risk of ability to destabilize the grid and the cost increases that you would see and all of those questions have been answered in favor of renewables and I think that's been, that track record is pretty surprising. If we stay on that trajectory then I am confident that we will get to 2045 but there's still a lot of work to do between where we are now and then. I think one of the key things that we're going to be banking on is continued technology change and cost improvements. DoE has a series of what they're calling Earthshots for long duration storage, hydrogen use, lithium ION batteries or grid storage, and a handful of others, really trying to push the envelope on being better technology at a lower cost that's going to enable energy transitions like the one Hawaii is undertaking right now to actually be successful by 2045.

Q: Great. Thank you, Stephen.

A: Thank you. It was great to be here, Marty. I appreciate you inviting me on.

I really appreciate it. We've been talking with Stephen Walls, deputy chief energy officer of Hawaii State Energy Office.

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