

MARTY ROSENBERG

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BRYAN HANNEGAN Interview

Q: Hi. Today we're very excited to have Bryan Hannegan with us. Bryan is the President and CEO of Holy Cross Energy out in God's Country in Colorado. Hi, Bryan.

A: Hi, Marty.

Q: Tell us a little bit about where you are. I think you're-- if you head west from I-70 and hang a left around Glenwood Falls, is that about where you are?

A: It's about where we are. We're about 2 hours due west of Denver on interstate 70. We actually serve the area of Vail all the way through Glenwood Springs which is along the I-70 corridor, and then we serve the Roaring Fork Valley from Glenwood Springs up to Aspen and a little bit of the territory on the south side of the highway on the way out to Grand Junction. It's a pretty spread out, diverse service territory. It's got a lot of mountains, a lot of challenges but also a lot of opportunities.

Q: I remember going fly-fishing with my son in Basalt, and I think you have an exciting project going on at Basalt regarding zero net energy use and tell us about that.

A: Thanks, Marty. It's a fantastic project. It's called the Basalt Vista Affordable Housing Partnership. It was a brain child of our local habitat for humanity chapter in the Roaring Fork Valley. They identified a need, as in most mountain towns that are heavy with tourism presence, a need for affordable home ownership opportunities for teachers and other families in the local work force. They secured some land right next to the Basalt High School in that area and worked with the county to put in all of the improvements, the roads, etc. The school district donated the land. The county donated the improvements. Habitat, of course, donated the labor and the materials for the homes themselves. Basalt is an area that has a very strong commitment to clean energy and, as such, had passed a local moratorium on the use of new natural gas for heating in particular, and so Habitat approached us and said,

hey, you guys, we got to do this. It's an all-electric community, but we'd like to do it in a very sustainable way, so can you partner with us to help design it in a way that maximizes the use of on-site renewables as part of our power supply? We had been working-- inadvertently, we had been working with the national renewable energy lab with funding from energy efficiency renewables and also with the office of electricity to do some modeling work associated with the grid modernization of our system. It just so happened that that analysis was right in the area where Habitat for Humanity wanted to come in to do work, and so we had the modeling capability. We had done some hardware-in-the-loop testing in the laboratory at NREL, so it became a ready-made field demonstration site in partnership with our local community.

Q: This is an all-electric net zero community of homes, the first of its kind in rural Colorado. It has to be one of the few in rural America. Do you know of anything like this anywhere?

A: No, it is one of the first in rural America, and frankly, it's also among the first in terms of a net zero, all electric community in the country. There are similar developments going on now in utilities all throughout the country, but this is the first one that we're aware of in Colorado that's been taken on, directly focused at the affordable housing segment.

Q: Where are we right now? Is it constructed? Under construction? Where is this?

A: The project will have 27 houses when it's all done. Those houses are in process of being constructed over the next year or two. We've completed work, and tenants, owners have taken occupancy of the first 4 which were the subject of our focus. Each of those 4 homes has a roof-top solar system about 8 kilowatts in size, a lithium ion phosphate battery with blue ion energy in the utility closet in each home, a heat pump water heater and air source heat pump, and a level 2 AV charger. The thing that makes this even more of an interesting project is that all of those devices, those distributed energy resources or DERs are individually controllable with an interface and a set of algorithms that we've developed in consultation with the national lab and its partners. We're able to manage, control, and dispatch those DVRs as part of our distribution grid. It's given

us a really great insight into how a more distributed energy-based future can actually operate in practice, and we're looking forward to scaling it up with additional developments in our area.

Q: These 27 houses, are they abut each other, or are they spread out across an area?

A: It is all part of the same community. If you think of a neighborhood of duplexes and triplexes located on the hillside behind the high school, you know, think of a community that has a mix of distributed resources and also some community-scale resources. As we build out the next set of homes in the 27, we're looking at maybe putting the storage in more of a neighborhood configuration as opposed to a battery a fourth the size in each of 4 homes. Maybe we have the same sized battery, but it's located at the pad mount transformer for example. It still allows us to dispatch it in parts to support the needs of the grid or to support the reliability or resilience needs of the consumer, but it's possibly constructed in a safer and more resilient way.

Q: Will these 27 constitute a microgrid?

A: Yeah, in fact, that's one of the really neat aspects of the algorithms and the controllers that are used in this project. We actually can set the amount of energy that passes through the controller between the distribution and the residents. We can set that number to whatever we need to set it to based on local grid conditions, a price signal, or in the case of a microgrid, we can actually set that interface to zero where the building is actually neither consuming from the grid, contributing to the grid; the grid isn't there. We call it more of a functional microgrid which is a different way of approaching resilience. This area of Basalt was the one that was most significantly impacted by summer 2018 wildfires that left us one transmission pole away from losing the ability to serve not just the area of Basalt but also the Roaring Fork Valley and the city of Aspen over the July 4th holiday which, interestingly enough, is one of the biggest days of the year.

Q: Let's step back for a second. You have had quite a history at NREL in Golden as an assistant lab director for energy system integration. Part of that was Vice President of Environmental

Renewable Energy. You oversaw quite a bit of research into cutting edge issues in terms of smart grid and grid evolution. How much do you view that as a learning experience that you're actually now tapping and using it in a hands-on way as you help run the Holy Cross Energy?

A: This is very much an opportunity to translate research to operations. I first became familiar with Holy Cross Energy when I was at NREL and we were looking to bring industry partners into the energy systems integration facility which was the facility and the part of the laboratory that was I fortunate enough to manage from 2013 to 2017. It was through a series of discussions with Holy Cross about partnership that I became aware of the leadership opportunity on the utility side of the ledger, and I think it's very rare that you see folks involved in energy research being able to come into an operational environment like a utility and have the ability to put their efforts where their mouth has been, to be blunt. I hope that we see more of that because, I think, having access to technologies, understanding how the partnerships work, understanding the art of the possible, you then come into this operational environment and start to ask how we make it happy from a business model perspective? How do we make it from a company culture perspective embracing innovation, all the while maintaining the safety and the reliability and the affordability of what we provide? How do we develop the partnerships and the collaboration in our community as a utility the same way a research institution would? I think there's a lot of things that translate. To actually make the innovations deploy at a scale and a pace that matters, we absolutely have to have the practitioners in there, and I really am enjoying the opportunity to work with boots on the ground and have some great activities underway in our territory.

Q: I'd like to slice the significance of this in a variety of ways. First, I want to ask you-- you have 167 employees serving your 43,000 members, the last time I checked. Co-ops, munis, public power entities by their size have not been a magnet for technologically savvy engineers and folks on the cutting edge. Do you think you're changing that, or are you putting the light on that by what you're doing here?

A: I think so. I think we're changing it just by showing what can be done with Basalt Vista and some of the other projects that we

have, some of the actions we've taken into procure cleaner energy supply which incidentally saves us money. That's the other thing, Marty, that I think is happening now is that co-ops and munis have traditionally been focused, and rightly so, on the cost of electric service. They always viewed research and innovation as sort of an extra cost on top of the normal course of doing business. I think with how technologies have evolved over the last decade, thanks in large part to big investments by the federal and state governments and the research contributions at the labs and universities, we're now kind of flipping that narrative on its head where you almost need to embrace innovation and try different things in order to stay competitive. We're able to, over the next couple of years, bring on new sources of wind and solar energy that will move us to a 70% clean energy content in a very short period of time and save our members money. If we didn't embrace the innovation and the challenge of doing that with these new more variable sources of supply, if we didn't think about how to build a distribution grid that was more flexible and capable of absorbing those new resources, we wouldn't be able to realize the cost savings in our power supply portfolio and ultimately pass those on to consumers as a more affordable source of energy. I think it's a completely different narrative now than even just a few years ago, and I think you see that playing out whether it's an IOU, a muni, or a co-op. We're all sort of seeing the same thing, and what's great about the co-ops is, once one co-op typically does something, the others look around and go, well, hey, how can I do that too? There's a lot of sharing and comparing. We've seen that just in Colorado with some of the other co-ops that have said, hey, I want to do something like that too. How did you do it? Can you help me? Can we partner together? It's a really encouraging trend if you're a fan of clean energy.

Q: I would imagine a lot of the players in this project, the solar provider, the solar unit providers, the heat pump providers and manufacturers, the inverters folks, because this is an experiment, are willing to give you equipment at a very good price. Talk a little bit about the economics of this. Do you think it's ready for prime time? Or is it going to be a while?

A: Well, in the case of Basalt Vista, it was the first of its kind. We were assembling a number of technologies and providers together, and we were doing it in a way which befits a Habitat

project with the contribution. For us, it was an investment in what we think will be a future business opportunity to actually package up these technologies and work with our local installers and our local firms to create resilience options for homes and businesses that want those as kind of a plan B in case the plan A of the grid goes down, but I will say that we have some great community partners. The solar provider at both Basalt Vista and at our home campus, Sunsense, a local Carbondale based company, super great to work with. We've also worked with other national firms including Powerfield which has a very innovative ground mount solar approach that's really kind of pretty simple. It's gravel in buckets and solar panels on top of it. It sounds very simple, but it's also very elegant. For us, it's also great because it's located in an area on our campus that may some day be used for another purpose, and we now have a solar farm that can sit there and operate to support the campus until we need that space, and then we can pick it up and move it somewhere else. I think there are a lot of really interesting partners to work with, and they are all eager to work with utilities to figure out who we are and how we tick so that that they can scale up their businesses and ultimately have a bigger impact too.

Q: Is Habitat watching this as a possible model to take into urban areas?

A: Yeah, yeah. In fact, Habitat nationally has featured this Basalt Vista project, and really have to-- hats off to Scott Gilbert who is the executive director there in the Roaring Fork Valley. He's been relentless in bringing this together. It's now been nationally and even internationally featured as-- if we're going to have affordable housing, let's focus not only on the affordability of the structure, but let's focus on the affordability of the operations. The occupants of the 4 homes, the families that occupy the 4 homes that we've constructed with all of these technologies, since they've taken up residence, they've paid very little in their utility bills on a kilowatt hour basis. They pay the minimum grid connection charge, but because they're generating most of their electricity locally, that gives them a flat and predictable energy bill to go along with a relatively affordable mortgage. I think that if you look at affordable housing, both rural and urban area, this is the way of the future, and it has a lot of potential.

Q: What are some of the technologies that you're most proud of, that you might want to show case that's really cutting edge?

A: Well, I think, I'm really proud of the fact that we've embraced electric transportation in ways that a lot of utilities are doing now, but we were one of the first out of the gate. We actually offer a 100% full rebate on electric vehicle chargers for homes and workplaces. We actually also pay for all of the installation costs if a municipality or community comes to us and says we want a fast charger in our park or in our town square or places where we know people will gather. If our system is already built to handle that there. If it's one of our favorite pre-screen locations, we will go ahead and paint it, put that in because we believe electric transportation is good for the consumer, and it's cheaper. It's good for the environment, of course, because of the reduced, but it's also good for Holy Cross in terms of an increased demand of electricity, so it really meets that beneficial electrification test. I think we're on the cusp of seeing the same thing when it comes to heating. In our mountain communities, heating (not cooling) is a big source of electric demand or gas demand in the mountain environment. Through Basalt Vista and other projects, we're getting a lot of good experience with heat pumps and how they work and work really well in cold climates and how that can lead to electrification in the mountain environment which, again, has all those benefits. I'm really excited about that. I think the next thing on the horizon for us, which would make sense given my background at NREL is how do you develop the distribution grid that has all of the visibility, the flexibility, the controllability that you need to manage thousands, if not tens of thousands of those distributed assets, all working in concert to keep the lights on.

Q: You have 43,000 customers. Is this kind of technology, do you think, poised to serve to move out rapidly once you demonstrate the case of how it works?

A: I think it is to the extent that we can also demonstrate a financial case that works for the consumer. A lot of the barriers that we've seen thus far in the uptakes around electric vehicle charging or heat pump water heaters or any sort of large capital expenditure has been the fact that the consumer is not walking around with thousands of dollars just ready to deploy at a

moment's notice. That's where I think some innovative rate structures that provide compensation for the benefits that DVRs can provide, peak load reduction, voltage regulation, some microgrid and resilience capabilities. I think we can be creative about how the services can be paid for in a way that benefits both the consumer and the utility. I also think that the utility can play an important role by investing in these DVRs as a utility asset the same way that we invest in the poles and the wires and the trucks today. We can invest in the battery storage and the PV panels and the heat pumps and the water heaters going forward in a way that allows the consumer in effect to lease to own them. We've talked about on-bill financing. We've talked about access to low-cost capital, which co-ops can get in big chunks. How do we deploy that to the benefit of our members so that they effectively just call us up and say, "I'd like the resilience package please. Can you add it to my bill?" We take care of all the procurement, the installation, the operations, the maintenance. We provide that electric service with these assets on site in a different way. All the consumer sees is clean, affordable energy, but they see a second line on the bill which supplements their existing line for kilowatt hour consumption when they need it.

Q: You mentioned the forest fires that came through that area. Do you think as you move towards a more distributed network you will have more resilience to ward off those kinds of threats?

A: That is our hope, but it is not guaranteed. I think grid architecture plays an important role in that as does the ability for us to have more visibility into where and when and how our system is moving electricity around. The area in particular between Basalt and Aspen is served by one looped transmission line where both ends of the loop pretty much go down the same right of way, so it is a potentially critically impacted area in an event of a wild fire or winter snow storm or cyber event or any hazard we might be thinking about that can impact the ability to deliver service. We engage the Rocky Mountain Institute in the summer of 2019 to bring the community together to say, okay, if this thing ever happens again, if we have another wild fire (which it's not really "if," it's sort of "when"), what are we going to have in place next time to be more resilient? That's led to a discussion around in-ground renewable energy resources in places like just south of the Aspen airport which is not the

cheapest place to build solar, but in this case, it's one of the more resilient, and that provides a measure of support for critical loads within that community. We've been talking with communities up and down that valley about microgrids or critical infrastructures for town halls, police stations, gas stations, hospitals, and other medical services. I think designing that architecture in a way that gives resilience to those critical resources, it allows you to think through the "what happens if" question. When that disturbance comes to pass, you need to be ready with a plan B, and you ought to use the blue sky days of today to plan on how you're going to execute the black sky days of tomorrow.

Q: I'm sure you still have many friends back at NREL. Given that you've been out in the field for 3 years kicking the tires of a real co-op, what would you like folks back at NREL to start researching? What kinds of problems and issues do you attach greater importance to now that you've been out there?

A: I think I would simply encourage them to double-down on doing research projects that are at a more intermediate stage of technology development that have some element of both laboratory and modeling simulation work along side a field validation or a field deployment phase. I think we have a lot of the technology that we need. The ingredients are there in order to enable this cleaner, more resilient, and more affordable energy feature. I just think that we need more doing as I used to say at a scale that matters. To the extent that they can affirmatively reach out to and the department support them doing so-- that they can reach out to the non-big actors, you know, the Southern Companys, the Dukes and the PG&Es of the world. They have tremendous staff. They have great research capabilities. When I arrived at Holy Cross, we had a research staff of 0. Now, we have a research staff of 1. That one guy is fantastic and does so many different things. A lot of co-ops are like that. They're not going to engage the laboratory in response to a call to proposals. The laboratory is going to have to approach them and say, hey, what can we do that will help you solve the problems that you face today. The other piece of it is marrying the technology development with the business model and the financial model that goes along with it. We can have all the best technology in the world, but if we don't deploy it in a way that's of benefit to the consumer or benefit to the utility that

gives them a continued economic future, then all that technology development isn't going to get us anywhere. I think paying attention to the finance side of things is very important.

A: I imagine you're having about as much fun as you would have, maybe more, than if you were at a large IOU. Is that the case?

Q: Well, I don't know. I think with investor-owned utility, you have the opportunity of scale. If you're a climate scientist like me and you care about doing something about the global climate, you care about taking tons out of the atmosphere or preventing it from getting in there. Holy Cross's carbon footprint, not too many years ago, was about 1 million metric tons which is a very small amount of the billions of tons that we have going into the air every year. I think you trade the ability to operate closer to the ground and with the community, with that collaboration which I really dearly love. It's a great region to serve, very engaged and very smart people that we work with. You trade that with a limited ability to the needle on a more regional or national scale. What I would hope is that all utilities share the common interest in giving their customers what they want before somebody else does. I think that's really important whether you're an IOU, a muni, or a co-op. I hope to see that take hold as we go forward in time.

Q: Great. Thanks, Bryan. I really appreciate it.

A: Thank you, Marty. I appreciate it too. Thank you.

Q: Thanks for listening to Grid Talk. Thanks to Bryan Hannegan for sharing his insights about changes in the electric sector, particularly in rural Colorado. That may have implications for all of us. Please send feedback or questions to GridTalk@NREL.gov. We encourage you to give the podcast a rating or review on your favorite podcast platform. For more information or to subscribe, please visit SmartGrid.gov.