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**MICHAEL SACHSE INTERVIEW**

Hello and welcome to GridTalk. Today we have with us, Michael Sachse, the CEO of Dandelion Energy, and we're going to talk about all things geothermal.

Q: Hi, Michael. How are you?

A: I'm great. How are you?

Q: Good. So, let's dive right in since you like to go underground it seems. Talk to us about—well, let's start with Dandelion. You just got a cash infusion of \$70 million dollars of financing in November. Tell us what's that going to enable you to do? You've connected 1,000 geothermal homes in the New England area. Give us the backstory of your company and how you founded it, and how this financing will allow you to accomplish.

Q: Yeah, so Dandelion was born within Google X, and I should say while I'm very happy to be the CEO, I'm not the founder. Kathy Hannun's the founder and she's leading our product efforts and really, we became focused on sustainable heat so if you think about what we need to decarbonize, heating's really a challenge because so much about heating is...comes from burning natural gas;

a lot of homes burn fuel oil, and so really, we got focused on that problem. How can we solve that problem? That problem, of course happens to be in the news a lot these days with everything going on in Europe, and we got focused on geothermal. Geothermal and when I say geothermal, I'm talking not about the deep utility-scale like find a pocket in the earth's magma but just something you can install in an individual backyard so...

Q: So, let's stop right there and talk about the universe of geothermal. There are companies like Ormat I'm sure you know, that are on 30 countries. They have projects around the United States where they tap into underground heat; think of Yellowstone's Geyser's, and they have in Steamboat, an 84-megawatt production facility. They have another one that has 143 megawatts. California's number one in that kind of kind of utility-scale, geothermal, yet you're focused on New England, New York, Connecticut, Massachusetts which is not hot the way-out West is, so you go way more shallower. Talk about the universal potential of from a 30,000-foot level of the utility-scale versus the residential about what could be accomplished.

A: Sure, so I would think about it; I really think they're not in competition with each other. Utility-scale is providing a source of electricity that's sustainable, and we need more of that. What we're doing is providing a source of heating and cool-

ing that is enormously efficient and so our approach; utility-scale would need to be really in places where you have more volcanic activity so that's why it's going to be more out West than New England would seem to be a strange place for it. Whereas residential geothermal which really is another temperate as ground-source heat pumps, residential geothermal can be installed anywhere. It doesn't matter what the volcanic activity way under the ground is. We go about 350 feet deep which by geological standards isn't very far, and so it can work in New England..

Q: You really go that deep? I thought it was more shallower.

A: So, you can go...you don't have to go so deep. You could go, once you're below four feet you're getting to that constant temperature of about 50 to 55 degrees but the challenge is then, if you can do it horizontally but then you need a lot of space and so, we go deeper in order to make it available for homes that have smaller yards, so we don't need a home to have an acre or two; we can do a pretty typical suburban home and you just drill straight down and once we're done, you never know it's there.

Q: So, I assume it's just geographic access that you picked those three states; maybe it's where you live. Could you do this for every homeowner? And B, what's the business challenge for you to convince somebody who has natural gas or electric-fired or oil fired, to total de-plug and come to you? Do they have to wait un-

til their equipment fails or do you make a business proposition that works at the get-go?

A: The way we think about it is it's pretty similar to how to convincing someone to switch from a combustion engine to an electric vehicle so if you just bought it, our odds of convincing you are pretty low but if you have the sense that my car's getting older and in this case my HVAC system's getting older; I'm going to need to do something eventually; those are customers who we tend to find and are pretty receptive. And then the other thing that we see a lot of is customers particularly around this time of year when the heating systems are turned on notice how much they're paying, have a sense of frustration with the volatility of the prices and that becomes another reason that they're willing to consider us.

Q: So, is heat pump 101; if I were to go with you, would you rip out my air conditioner and furnace and put new equipment in? Would the initial cash outlay be comparable; less or more? And what's the payback scenario?

A: Yeah, so yeah, we'd rip out your furnace and air conditioner. Put in a ground-source heat pump that would do both. The cash outlay at, so the cash outlay before incentives is meaningful. It would be about \$40,000-\$45,000 bucks for typical, sort of 2,000-2,500 square-foot home. After incentives and there's a com-

combination of both utility incentives and federal incentives, it looks more like \$22,000 bucks, and that's usually going to lead to a payback somewhere in the 7-, 8-, 9-year range.

Q: Okay. So, when did you start and how hard was it to get to 1,000 installations and what's your forecast for the next two to five years?

A: Yeah, so we started in 2017 and the easy thing in this company has always been the demand. We've always seen terrific demand. The hardest thing has been the coordination of the various trades and then really building the expertise in drilling, and that's one of the things that's gone great recently in particular so last year; well, I'm treating 2022 like it's last year already. In 2022 we will have installed about 400 homes so really the rate is increasing quite a bit. And then going forward it's really kind of a wash, rinse, repeat. It's about buying drills, paying drillers, matching them with HVAC installers. And then of course, being able to find customers who are interested in the product, but we haven't seen any limits there just yet.

Q: So, that \$70 million dollar round of financing that closed in November, my understanding is the source of that funding was a company involved in homebuilding. Does...is the business proposition different for retrofitting somebody versus getting out there

and creating new homes with this technology at the git-go? Is it significantly less expensive to build it this way from the start?

A: Yeah, so Lennar, largest homebuilder in the U.S. was one of two leads. The other was NGP, terrific energy-focused firm and you really but yes, it's easier when you're doing it from the start cause as you might imagine, little things like having to take a heat pump down basement stairs and putting it into a crawlspace can be much more difficult than just putting it in when the home is not even fully framed yet. And by the same token, when you have to think about people's shrubs and making sure that the driveway isn't affected, that's a lot harder than when you can just drill a hole, move 30, 40 feet over, drill another hole and keep going so yeah, it's cheaper when we can do it from the beginning.

Q: So, let's talk about magnitude of cheapness. If it costs \$40,000 to retrofit, what does it cost to put one of these into a new home? And this podcast is run by NREL. Is there new technology coming out that offers the potential that just like solar, this is going to experience a cost-declining curve?

A: Yeah, so we think that cost in new construction is going to be somewhere between 40% and 50% less so meaningful less. Now it's important to note that's true when you're getting production-scale, right? as you do 100-200 homes a month and then I am

very bullish that we're going to see meaningful cost reductions through technology improvement. We're working on a lot of them ourselves and that's part of our mandate with this new financing round and...

A: Well, talk about that. Do you have a lab, or do you have grants from DoE or NREL or how's this working?

A: Yeah, so we have a team in Boston. They did not get to meet Prince William and Princess Kate but they're in the same facility, and we've been working on a lot of things around improving the cost of the heat pump and also improving the efficiency of the ground exchange and really when I say that, what I'm talking about is the less ground loop we have to install the cheaper geothermal becomes so that's something we're really focused on as well. And we are looking for ways to collaborate with the government. There's a lot of focus on heat pumps right now and so we're hoping that we can be a part of that.

Q: So, just as this thought occurs to me, I thought I'd run it by you. Is there any synergy for you to get involved with this technology and deployment of residential solar and energy storage? Is there a three-way marriage that we can effect here?

A: A hundred percent, like so the hard part is bringing it all together in one place like just from like getting all the businesses to have...be in the same place at the same time, but all

three systems work beautifully together, so solar's creating electricity; storage obviously is storing it. Ground source heat pumps or geothermal are consuming electricity, they're part of electrifying the home, but...

Q: So, it takes electricity to run this and solar could be that source?

A: That's right, that's right, and we've done some modeling on that and we actually think it's a great deal for customers because solar's a cheaper source of energy and so that means your heat pump is going to cost less to run.

Q: And the payback will be faster?

A: Exactly.

Q: So, is Lennar looking at this triple play?

A: So, we've been talking about it with them. The challenge is we're just all trying to get things going together so like solar for them is important in California. We expect that geothermal is going to be more important in say Colorado or Minnesota to start and so we're just going to try to get some geothermal communities going and then take it from there.

Q: So, talk to me a second about...we talked about incentives. There's the Inflation Reduction Act of 2022. What specifically does that offer for geothermal residential heat pumps?



A: So, the Inflation Reduction Act did a number of things that are really good for us, so it took the Investment Tax Credit and for first parties, increased it from 26% to 30% and extended it for 10 years so that's new or nearly new or just paying cash or getting a loan, installing something in our home. The other thing it did was it took the ITC for third parties, so this would be the basis of a loan—sorry, of a lease and this is something the solar industry has used for years. It has been 10% for geothermal. It took it up to 30%, so we now think that a lease model is going to be very attractive for consumers. And then the third thing which wasn't intended for us, solely for us but it is important is, the 10% bonus ITC for domestic manufacture is going to apply to geothermal, so that only applies in that third-party lease scenario but that means that third-party lease ITC is now 40% so we think that's going to make a lease really attractive and we also think that's going to be something that is going to allow us to get a lot closer to providing heating as a service and that's something we're really interested in doing.

Q: Talk about how a lease would work. Would you be the party that initiates it? Could you team up with a natural gas utility that may be threatened by your business model, and they want to join in with you?

A: Yeah so, it's early days and we're trying to figure it out, but I think all those things are in play. The way we see it is the ground loops look a lot like a utility asset. They look a lot like pipes that are transmitting natural gas. We think it makes sense for a homeowner to pay for that over time and then with the increased ITC we think that is going to be more affordable than a loan and that consumers are going to like it because it means someone's responsible for making sure that the heating and cooling is working well in your house, so...

Q: So, how might a lease work if it's from you or from the utility? I basically would not have to make the \$40,000 outlay; a third party would do it and they would potentially say to me, "You'll save 10% a month on the heating of your home."

A: Yes.

Q: Would that be...

A: So, the parallel here is solar so the solar industry has about 30% of solar systems are leased and the idea is that a lease is going to both cost a little less just due to the way it works and then you have a third party that's responsible for making sure it's functioning and that's basically how it would work here, that we'd say, look, whether it's just the ground loops and the heat pump, that's leased, you pay monthly for that. You're going to have a predictable energy bill and then there's going to

be a service company's that going to be responsible for making sure that your home's performing as you'd hoped.

Q: And might this like solar be a situation where the third parties; dentists, doctors, lawyers that have money they want to invest to reap the tax benefits, to put the capitol forward and the entity would go out and deploy the asset?

A: That's right. I think everything we're thinking about here and in a lot of ways our business is residential solar applied to another setting and so all these things including those components we imagine working in a very similar way.

Q: So, what if you've done some modeling and forecasting how long will it take before 50% of the homes in America are headed with geothermal heat pumps? Will it be our lifetime essentially; 10 years? What's your best estimate?

A: I, so I would say that I would hope that it is within our lifetime, and I think what it is really going to be dependent upon is...

Q: Just to be precise that half of the homes in America or what's your hope?

A: Yeah, so our hope is that geothermal is a terrific fit for any part of the country that has hot summers and cold winters so that's about 33 states and so we think that's about the market potential and we see adoption really depending on more than any-

thing...the thing that really unlocked solar was the ease and availability of labor to install solar panels and we think that as geothermal gets easier to install and there's more labor available that's skilled in it, that's what's really going to drive the acceleration, and that's the big limiter at the same time, like that's the thing we need to grow.

Q: Michael, one thought that has occurred to me as I talk to you here, I'm sitting on cul-de-sac in rural suburban Kansas City and there's an island in the middle and surrounded by 8 homes. Do you come in in a situation like that and put in one huge geothermal sync and then tap into 8 homes if we elected to go with you or is...

A: A hundred percent.

Q: A more one-on-one, or how does that work out?

A: A 100% we could, and we've been experimenting with some utilities in the Northeast about finding some cul-de-sacs where we might do that. They're very eager because they're also motivated by cutting off some leaky natural gas lines and fully electrifying those homes.

Q: Which, just a few years ago here in Kansas City and elsewhere was a huge problem with gas lines exploding because of aged pipeline infrastructure.

A: Yeah, I think it's an enormous opportunity because the utilities don't, would prefer not to invest in what they do of as some of them do as potentially stranded assets and the hardest part is just getting everyone to agree at the same time that we're going to make the switch.

Q: Let's talk about your journey for a second. When you first met, you were at Opower where you were creating new interfaces between customers and utilities to promulgate adoption of renewable and energy efficiency and new technologies. You were there 7 years and 7 months according to LinkedIn, where you worked on marketing and business development. What lesson did you take away from that work?

A: Well, a lot. I didn't know anything about really anything before I got to Opower but I would say a few things like first, it is easier than people think to work with state regulators. That was something I got pretty good at and learned a lot about and I find that when people think about regulation, they think about the federal government first and the federal government's enormously important but everybody knows that and everybody spends a lot of time there and the states play a huge role and are eager to help companies figure out how to work in their markets so that's been something I've learned a fair bit about. I've learned a fair bit I'd like to think about building companies

with great teams and one of the most important things is hiring in a company and I think we were lucky at Opower or not lucky but being deliberate about being really good at that and I've tried to bring that forward, and those things have a multiplicative effect. And then maybe a third thing I'd mention is living with and appreciating the ups and downs of the climate space. Opower started as Clean Tech, then it became Vertical Sass. The business didn't change, it was just what the market wanted so we changed what it was called. We're at a similar moment here where climate tech is hot. I expect climate tech may not be hot in the future not because the problem's going to go away but because investors follow trends and things may change for them. And so, just making sure that we're really thinking about building a great business that can stand on its own two legs, with or without a sexy label.

Q: So, as I recall, the secret sauce at Opower was trying to incent consumers to give a fig about efficiency and sustainability. What do you think the American consumer is today, post-COVID and all the talk about climate change, is the environment changing? Is the American public hungry for what you and others are offering? Do you sense a change out there?

A: The think I sense, I think efficiency is still a touch sell because I think people don't really know what a kilowatt or what a kilowatt hour is or what a BTU is and there's just too much fog

in the details. But what I think, there's a strong and growing emotional sense that people want to be sustainable, and they want to make investments that are going to speak to their values, and it doesn't have to necessarily be like a slam-dunk, it just has to be something that's not foolish to do and we see that all the time. The best example that I can give you is during the first few years of Dandelion, the way we found most customers was via Facebook. We would just put a little ad in front of them and they'd travel around the Web. Now, most customers come to us through Google ad words. Well, why does that matter? It just says that customers are looking for something. Doesn't mean they've made a decision or they're all in on a particular value prop but they're thinking about it in a way they weren't before, and I hope that's going to continue.

Q: Last question. You're a graduate of Amhurst. Seventeen years ago, you graduated from Harvard Law School. You've been an Entrepreneur in Residence at the New Enterprise Associates in D.C. The energy space has been historically very stable, kind of conservative, not courting innovation. It's basically been the same business model in technology for a century. How is that changing and given your background, what do you find most appealing and challenging about the work you're doing now day-to-day?

A: Yeah, I think what's changing is, there's so many talented, ambitious people thinking about energy problems, and it's become a place where entrepreneurship is welcomed in a way that perhaps it wasn't some time ago or at least it's more welcomed and so I think that's incredibly excited to see. We're lucky to be invested in breakthrough energy adventures and if you walk around and talk to the various founders and executives of their companies, it's just incredible, like the ambition and the challenges people are taking on and so when I think about what kind of, what that means, to me it means like there's just...it's going to be harder, right; it's going to be harder than say software businesses because it exists in the real world and so, you have to sort of accept that and embrace that as part of the journey. But what I love about it is, it matters, right? Like I think it really matters what we do about energy and sustainability over the next decade in particular and so, you're always looking for sources of energy when you're, no pun intended, when you're doing hard things and seeing other people feeling that pull as well is really encouraging.

Q: Thank you, Michael.

A: Thanks, Marty.



Thank you for listening to GridTalk and thanks to our guest, Michael Sachse, who's the CEO of Dandelion Energy. We are particularly eager to hear your feedback or questions [GridTalk@NREL.gov](mailto:GridTalk@NREL.gov) and we encourage you to give the podcast a rating or review on your favorite podcast platform. For more information about the series or to subscribe, visit [SmartGrid.gov](http://SmartGrid.gov).

END OF TAPE