Battery + Storage Podcast: Pioneering the Future of EVs and Battery Testing With Don Wright, Unico
Host: Bill Derasmo
Guests: Don Wright
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Bill Derasmo:

Welcome back to the Troutman Pepper *Battery + Storage Podcast*. I am your host Bill Derasmo, and today we are pleased to have Mr. Don Wright who's the vice president of engineering at Unico. Unico is based in Milwaukee, Wisconsin, but they have a global presence. Welcome to the program, Don.

Don Wright:

Thank you very much for the invitation today. I appreciate it.

Bill Derasmo:

Absolutely. As we were talking off-air about Unico a little bit, you guys are into a lot of things, but why don't I give you a chance to introduce yourself and your company, and tell us a little bit about some of the cutting-edge work that you guys are doing in the EV space and beyond?

Don Wright:

I grew up in Southeast Michigan. My dad worked for Ford for 32 years, so I've always been a car guy. Got my engineering degree in Michigan, and then immediately joined a company doing test equipment for the automotive industry, so testing powertrains. Of course, back then it was internal combustion engine powertrains, developing the test cells for that, did some really big projects for a lot of companies in the Michigan area. And then I guess in the early 2000, I moved into product management and I started to get into the electrification space. I was a product manager for a battery test application package, which allowed us to test battery packs for EVs 24/7, 365, unmanned battery testing and climate chambers. We've all seen videos of the test facilities that all of the OEMs and tier ones and startup companies are making. I started with that.

I then had the opportunity to move to Austria and do business development for a company called AVL doing electrification test systems. That was an incredible experience because I got to travel the world, I got to really see the emergence of electrification when it was first starting in China, India, Korea, Japan, of course, all over Europe, and then in the U.S. It was a great experience. I did lots of product management on large battery cyclers for testing battery packs. And then my last part of my career at AVL was doing cell cycling. So really helping our customers develop the next generation battery cells that they would be using in the battery packs.

And then mid-Covid, I guess, I actually had the opportunity to come to Unico here in Wisconsin. So I had known Unico for a long time. They were a drive company for a lot of the test systems

that I installed in Michigan. It was really an honor to join Unico as the director of R&D. And then thankfully, I've quickly moved up to vice president of engineering. So now I'm responsible for all of the R&D, the project engineering, all of our customer projects and products that we do for our customers, whether it's in the transportation industry, whether it's in eVTOL company, whether it's a marine company, pleasure craft, also in all of the other industries as well.

To talk a little bit about Unico has a long history as well. So they started in the late 60s. They were one of the first companies doing digital control of electric motors. That quickly evolved into the manufacturing processes, pressing, making metal forms for the automotive industry, cutting, the paper industry. It transitioned also into oil and gas. So lots of Unico drives out there controlling the pumps that we see to pull oil and gas out of the ground, which sometimes has a bad nomenclature, but we still have to do it, we're still going to be relying on it for a long time as much as the EV enthusiasts want to move away from it. But there's a lot of things in the world that still require petroleum. And so we're trying to do it more efficiently, cleaner, quieter. We have technologies that make that a better operation.

But, of course, our transition the last 15, 20 years has been into the electrification space in transportation, and it started probably in the mid-2000 with battery emulators on traditional test beds where you had hybrid powertrains. So an engine and an electrified component. You needed to supply DC power to that electrified component on a test bed. Unico had a technology back then that was quite unique and it still is where we could put a DC section onto the dyno cabinets and then allow us to then test both the internal combustion engine and the electrified components together. And, of course, batteries is an incredibly important part of the EV infrastructure, and so we do a lot of battery cycling products, testing big packs, very big packs actually. So we have a system in our facility now, it's 3,000 volts and two megawatts for testing large batteries for gen sets. It's a very exciting time to be at Unico and it's really cool to see all the amazing projects that our customers are requesting from us.

Bill Derasmo:

Well, appreciate that lead in, and clear to me that Unico is involved in a lot of different areas and has been for some time. And you have an interesting perspective because we're in the midst of the energy transition as everybody says. And based on what you're saying, you're a little bit maybe of an all of the above kind of guy in the sense that you recognize we can't make the leap to all renewables or all electric vehicles overnight, and there has to be a true transition period. And in the meantime, we're going to need some measure of reliance on fossil fuels. And to me, that's where I'm at and I think that's fair. But I think a lot of folks in our audience are very interested, obviously, the name of the podcast, very interested in the batteries, energy storage, EV space. And a lot of times we like to level set on the program, "Are we talking about e-Mobility, EVs, or are we talking about stationary grid scale applications?" I think today we're going to be more focused on the EV space, which is great.

And by the way, if you want to learn more about Unico, your company, it's UnicoUS.com, U-N-I-C-O-U-S.com. A lot of interesting information that I found on there leading up to the program. Tell me, there was a phrase that I saw several times on your website that I was curious about and this is the uninitiated because I'm a lawyer and not an engineer, but what does test stand systems mean because I saw that pop up a few times.

Don Wright:

Actually, that's a good question. I tried to describe it one time to one of the investors as we make exercise equipment for cars. Like you have a treadmill, you want to get on a treadmill and you can exercise. In this case, we would exercise the electric motors or we would exercise the battery pack. For example, you would put a battery pack on a large Unico test system, we would do a capacity test on that battery pack. So we charge it up to the highest voltage, then we would discharge it at some rate, 100 amps to 100 amps down into the battery pack's lowest voltage. And that would, of course, depend on what is the configuration of the battery pack, the chemistry, all that good stuff.

And we would then measure the capacity, and then we would cycle that battery pack over and over again in different climates. So maybe we cycle it 20 times at -20 degrees C to imitate a Wisconsin winter, and then we would do it at 80 degrees or 100 degrees Fahrenheit to simulate we're out in Nevada. And then after you do that a bunch of times, you do that capacity test again, and then you could determine, "All of those charge profiles degraded the battery this much, and this is where you have the state of health." Of course, if you drive an EV, everybody asks you, "What's the range of that and how long do the batteries last?" My wife and I, we have two EVs, two and a half, and so we're always asked those questions.

And this is so that the automotive companies can have an understanding, "In year five, year six, year 10, year 12, this is how much life is going to be left in the battery pack." And this kind of goes into the comment that you just said before, "Are we talking about transportation or stationary?" I firmly believe that it's mutual because as soon as the battery pack is finished in its first life in the electric vehicle, it still has 80% of its capacity left, and we should enable to make it live for another 15 or 20 years in a stationary battery situation. This is where we believe that the industry can pivot towards, and we make test equipment that not only tells the automotive companies how long the battery should last, but when it does get to the end of the first life, they can use our test equipment to determine how much life is left in that battery, "Is it worthwhile to bring it into a second life application or should we take it right to the recycling area?"

Bill Derasmo:

You know you're speaking my language when you start talking about second life batteries because we always geek out about that on this program. And we had Freeman Hall probably two or three years ago at this point on with his SEPV Sierra facility out in California that uses second life batteries. It's in operation today and it works great, and I think they're going to expand, but who knows? I think that that's an important point because of the issues that are coming more and more to the fore about, "What are we going to do with all these batteries as we transform our enormous transportation fleet more and more to EVs?" There's been a growing concern about, "What are we going to do with all of this stuff?" And that's one solution, I think, right? Is that it does have the second life. As you said, it has quite a bit of second life left in it where it can have a useful grid scale application. So it's important to hit on that point.

We just recorded an episode that's more focused on the finance side, but I want to tap into your engineering expertise. I'm sure you have finance expertise too that we could tap into. But on the engineering side, let me ask you about, again, another phrase that I saw a lot was drives and control systems. So when we talk about drives and control systems with respect to EVs and with

respect to the work that Unico does, talk to me for a minute about the importance of those components and what exactly are we talking about, again, for the uninitiated?

Don Wright:

Sure. I guess the phrase drives really is a legacy term, and it was really used for controlling an electric motor. Now, I don't mean controlling the electric motor from the actual vehicle, but if you can pretend you take your EV or even your combustion engine vehicle, and you connect motors to where the wheels are on that car, or maybe you're connecting it directly to the output of the engine or the output of the electric motor, you have another electric motor that you're controlling to act as the load of the vehicle. So it's acting as the load on the road if you're going uphill, going downhill. We could even do very advanced stuff like we have Torque Pulse Simulation. So if we're testing a transmission, we can actually simulate the torque pulses from an engine going into the transmission so you could do durability testing, test the transmission without actually burning fuel.

And to control those electric motors, to control that load, we typically use what we call it as a drive. So it's an AC control system that is then looking at the response. It's getting some set points from a larger automation system and saying, "Load this electric motor down to 20 miles an hour and put this much torque on it," and allows you to do drive profiles, allows you to do very dynamic things. So you could, for example, drive the Nordschleife on the test bed and be able to see how much battery is left after one lap. The drive is controlling the load, which is controlling the units under test, which would typically be the battery, or the electric motor, or the inverter, or the engine.

Bill Derasmo:

Who would you do this work with? In other words, who are Unico's customers? Is it the OEMs, the auto companies?

Don Wright:

It's the auto companies, it's the tier one suppliers. So if a tier one supplier is making electric motors or inverters for the OEMs, we supply to them. Startups, and then across all industries. So marine, construction, farming, the exploding eVTOL market, no pun intended, all of these industries need to have test equipment because not only do they want to test the durability and the performance of their actual components, but they also want to test out different control strategies. If you think about the eVTOL market, wouldn't you rather find out that you have a control issue on the ground in a test bed than maybe on a test light? Here, they could run through the control strategies, they could do fault injection where maybe they crack a rotor or something like this, and they can simulate that on one of the motors, then they can see, "Hey, how does the control system react? Would it have brought the vehicle down safely and landed on the ground?" We could do all of those things on a test bed, and that's what Unico provides.

Bill Derasmo:

Very interesting. And so aside from the OEMs, auto manufacturers, or as you say tier one, who are you seeing as this EV revolution kind of takes off? Who are some of the new players that you might be working with?

Don Wright:

Of course, I can't tell some of them because of NDAs and stuff, but let's just say lots of startups are using our equipment, a lot of the eVTOL companies are using our equipment, also battery companies. So as battery companies want to transition into new types of chemistries, semi-solid state, maybe solid state, we have all these different chemistries that they're trying to test out, make sure that they're going to exist, how fast can they charge them? If I charge them fast 1,000 times, will they still be having any life left? They all need to buy test equipment from us, and that's what makes it so exciting. There's so many different companies that are trying to get into this space that it really makes it an incredible time for us.

Bill Derasmo:

No, I'm happy to hear you say that because a lot of our past programs, we've had discussions about different battery chemistries. Obviously, lithium ion the dominant type of battery that's out there, and that's been in use both in grid scale and on EVs, but we've had a lot of discussion also about different types of battery chemistries, everything from iron, different types of iron applications, zinc, lead, vanadium was another one. We've had at least two programs on vanadium, which is interesting. So we've had a lot of different types of battery chemistry. It's going to be interesting to see which ones emerge. And, again, there's always the difference between what's going to be better for grid scale applications, what's going to be better for mobility, and things like weight and density and those types of things go into that equation. What are you seeing with that regard with respect to EVs? Are you seeing some of these other maybe solid state? Are they starting to emerge as a possible alternative?

Don Wright:

I would say semi-solid state, so not a true solid state battery. We're starting to see that one company, Factorial Energy, has got a nice product. They showed it to the new Dodge RAM at CES this year, I guess. True solid state has a lot of very interesting challenges when you'd have to build it into a battery pack. So you see lots of really interesting announcements on the solid state cell level. They, as far as I know, still require quite a bit of compression. They require quite a high temperature and also, they shrink and they expand as they charge like up to 20%. So you have to have a extremely rigid, high compression, high temperature structure that can expand and shrink 20% during the charge or discharge profile in a vehicle that's going to be driving on the road in all sorts of weather conditions.

And so honestly speaking, I love all the research, and I'm looking forward to a company to prove me wrong, but I'm a bit skeptical that that's going to be the next best thing in the next couple of years. It's still exciting. Semi-solid state is really exciting. Anything to make a safer, better battery that can last a long time, like we talked about, be used in a second life application again. And now you're talking the life of that first battery cell before it then gets recycled and turned into another battery, which also everybody seems to forget. That could be a 40 or a 50-year lifespan. That means the batteries that are in my wife's bolt or my lightning, that means it's going to be 2070 before it's ready for recycling. So we have a lot of life left in those battery packs and we can be using them the whole time.

Bill Derasmo:

I hope that comes to pass because it is a big issue. But when you start talking about 2070, that'll get people excited, that'll make people happy on that issue. Again, a large part of our audience, I think because of the world that I came out of, is interested also on the grid scale side, and you talked about the testing that you do at Unico with respect to charge, discharge, cycling, those types of things. And just to relay a quick anecdote from a few years ago with respect to the PJM market, the regional market at the wholesale level, they got into some issues when they first allowed batteries to be suppliers in the wholesale market and storage.

And one of the issues, I think, that the early adopters, the early installations faced was that perhaps the batteries were being cycled differently than they were intended to be. And so you'd have this take the battery all the way down and then fill it all the way back up, and maybe it wasn't really designed for that. I was just wondering if you could speak to those issues, and what are some of the things that Unico does on that front in terms of telling the owner of this battery, "Here's how to optimally use this thing'?

Don Wright:

Sure. It's the same thing with our usage of our electric vehicles. If you can keep the battery between 40 and 70%, that's where it's happiest. We're lucky we have a charger here at our house and a charger at work. Every night we can plug it in and then just keep it in that range and easily set it in the apps. And certainly if we're taking long trips, that doesn't work, but that's few and far between. What we do is, for example, we can do 10 test beds for a customer. And then what they do is they say, "In test bed number one, we're going to put this stationary energy storage system where we're going to do 10 to 90, discharge 10% up to 90%. The second one we're going to do 20-80. The third one we're going to do 30-70." And then maybe they do a full extreme one in the fourth one, or maybe they double it up.

And then they kind of run that program over and over again, and then they can really see, because they're cycling it multiple times per day, quite quickly, six months, a year later, they could really look at the different battery packs and say, "Hey, this one has a state of health of this. This one has a state of health of this. This is really the optimum range for us to operate on." And then you could put those control strategies into your energy storage system controller, the BMS, so that it makes sure that standard operating range in the summertime when you have plenty of sun and you're recharging your energy storage system, you can say, "Hey, here, I want to operate it at this."

And maybe everybody will have a thermostat in their house, they'll have a little battery controller and they'll say, "Hey, I sense that a storm is coming," or it probably does it with AI, right? "I need to turn up the battery. So hey, now I open my window from 10 to 90, but I can only do that a certain amount of time." So I think there's a lot of very interesting use cases that we can get into when you start looking at what is the best life cycling for that battery pack, and then we can design a control system around it.

Bill Derasmo:

Fascinating. Honestly, to me, it is. And I feel like that's an issue like you say. It's whether you're talking about grid scale or using it as a car, it's the same problem that you're trying to solve for.

Let me just ask you sort of an oddball question, but I like tapping into your engineering brain. What about the growing discussion around how EVs, when you integrate the charging system with your home, that it could feed into a home system where you might have rooftop solar, you have an EV, and it could provide perhaps backup power in the event of a storm? What are some of the things that people can play with in terms of home systems with respect to EVs?

Don Wright:

That's a very fun and interesting question. I have a lightning. I got the Ford Pro Charger, which has bidirectional charging. We didn't actually install it yet because we already had another charger, and we have solar on our house, which makes us that neutral. And here in Wisconsin and the way it's set up, you don't get that metering. So there was really no benefit for us to set it up so far, but it does open up the possibilities to have very interesting use cases. As I mentioned, and hopefully my boss is not listening, but I could drive my lightning to work in the morning and plug in at our charger for free, charge my lightning all the way up to 100%. I could bring it home, plug it into the house, run the house all night, or if I had a secondary energy storage in our house, I could charge that up overnight from the lightning battery, and then basically be living off of my work by powering our house.

It gives you options. I don't think vehicle to grid or vehicle to building or anything like this is the game changer that a lot of people think it is because at the end of the day, you're going to want to get in your EV in the morning and drive to work or drive somewhere. And if you used all the energy overnight to power your house, your EV doesn't have any power. But it gives you options, it gives you the ability, instead of installing an emergency generator in case the power goes out, I can plug my car into my house and be able to use it in those circumstances. That's the interesting thing about today.

And you talked about the different types of propulsion technologies and fuel cells and fossil fuels and electrification. The great thing is we have options. In the past, it was diesel or gas, right? Those were the options. Now, we have different technologies that we can apply to different applications, and we can say, "Hey, for commuter vehicles that are used in the city, battery electric vehicles is the best solution. Or long commutes for the guys that want to tow snowmobiles up at Northern Michigan for 600 miles in the snow and stuff like that, battery electric truck is not going to do it for you. You're going to need a diesel or a gas." That's fine, but if we can transition a majority of the transportation in this country overtook energy sources that can be renewable, that can be clean, that can be coming from the wind or the sun, I think it's only a benefit for everybody.

Bill Derasmo:

What you're saying makes perfect sense. The only objection I've ever had is that piece about, "Look, if you're going to be driving or towing something 600 miles in Northern Michigan and Northern Wisconsin, that's just not realistic," right? And so there's that aspect to it. But sure, if you can eliminate tailpipe emissions from a vast majority of the vehicles, of course, the air is going to be cleaner, the carbon emissions are going to be cut drastically, so those are all to the positive.

And there's so much exciting technological change that's just happened in the last few years. It's an optimistic future, I think, in the EV space. What else in terms of Unico, if you had an

entrepreneurial company, they've got a new battery, they think they've built a better mousetrap and they want to test it out, tell me a little bit about what they should do in terms of contacting Unico, and what sort of things that you guys could partner on that would help them to achieve their goals?

Don Wright:

We recently introduced a new concept what we call using a DC microgrid so that we could test more batteries at once in a facility without needing a huge amount of energy. Traditionally, if you would have, let's say, a battery cycler that was 500 kilowatts, which is a pretty good size if you're testing a battery pack, you would have to bring that power in from the outside, bring it into the building, and then you would have a big connection to that test system, and you can test that battery. But now if we're talking 10, 15, 20 battery cyclers, now you're talking megawatts of power. And if you have to have all of that infrastructure added onto your facility, maybe you don't even have the facility available, maybe you need a substation put in, we have the ability in some of our new test equipment to recirculate that energy on a DC microgrid so you could charge one battery while you discharge another. And the energy, it's like taking two cups of water and moving water back and forth.

And so we have concepts and we have customers that are doing that so that they could increase the amount of battery testing that they could do in their facility without this huge infrastructure charge. And talking about the second life battery, they could even put a second life battery on that DC microgrid so that they could then store the energy in a second life battery pack if they have excess energy and then reuse it later. So you could really have kind of an internal ecosystem of energy inside of your facility. And to try to get ahold of us, go to the website or contact me directly. My email is Don.Wright@unicous.com. Happy to help.

Bill Derasmo:

I think that's very helpful. I love the part about the microgrid. Now you're really speaking my language because sometimes it's funny how we get siloed into the different categories within the industry, but you're very smartly just applying the same concepts just in a different way. And that's really music to my ears because I think we've talked some about microgrids, and, again, I think that's another aspect of the future. For your facility, it makes perfect sense, but for other sensitive facilities where you have the ability to either build in redundancy or use storage in an innovative way like you have that, I think microgrids are going to be part of the picture as well.

Anyway, we really appreciate the discussion today. Like I said, sometimes we have a heavy on finance or heavy on regulatory type discussion. I do like the heavy on engineering and electrical engineering discussion because for me as a lawyer, I'm just fascinated by all this stuff, but I will admit, I am not an engineer. So I have to rely on smart people like you to get me through. Really appreciate the discussion. I'll let you have the last word if there's anything else you want to add to what we've hit on today.

Don Wright:

I want to thank you very much for the conversation as well. It's been really cool. Just a side note, a fun thing. So my wife and I are also converting a 99 Jeep Wrangler to electric using second life batteries out of a Mustang Mach-E. It's all documented online. We also see that

there's a really fun part of this second life battery application where people are converting classic cars, their dream cars, and then making them electric again. So not only are we talking the commercial aspects and the entire environmental aspect, and all of the things that are related to the topics we were talking about earlier, I also think that there's a very fun part that's coming about and that's being enabled by lots of different organizations out there. And, again, if anybody's also interested in that, I'm a big DIYer, I'm on the internet forums for DIY electrification, and you could reach out to me as well if you have any questions.

Bill Derasmo:

See, I like ending with a fun note. I'll add to the fun. What are the odds that you would have two people get married who are super interested in this particular space? I have to ask: how did you meet your wife? What's the origin story there?

Don Wright:

That's pretty simple. So we both worked for the same company, AVL, in Austria. She has a PhD in technical physics and was heavily into the battery development space. She actually wrote a book called The Drive to Electric, which you can find on Amazon. She's a consultant in the EV battery space. I was on the testing side. So we had lots of common conferences and stuff that we went to. One thing led to another, and now we're on the middle of Wisconsin doing battery stuff.

Bill Derasmo:

Sounds fantastic. I love it. I love to hear it. Thanks again for being on our program. And everyone should check out Don Wright, Unico, and the great work that they're doing, and we'll leave it there. Thank you everybody.

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