***Battery + Storage Podcast*: Powering Anything, Anywhere With Alex Livingston, Joule Case**
Host: Bill Derasmo
Guest: Alex Livingston
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Bill Derasmo:

Hello, and welcome to the Troutman Pepper *Battery & Storage Podcast*. I am your host, Bill Derasmo. With me today is Alex Livingston, the President of Joule Case, J-O-U-L-E Case. Welcome to the program, Alex.

Alex Livingston:

Bill, great to be here. Thanks for connecting up with us and happy to talk about batteries and storage.

Bill Derasmo:

That's the name of the game here on this podcast. Happy to have you on. Alex, you are from Idaho, I see, University of Idaho, Boise State. I believe that's where you work out of in your company. Tell me a little bit just about your background, how you got started in the space and what your career journey is and how you landed at Joule Case.

Alex Livingston:

Absolutely. An interesting journey. Idaho, as you're well aware, potatoes. Potatoes, famously, you take a huge number of them, can make a very tiny battery. But we were not making potato batteries here. Actually, so Joule Case is my second battery startup company, both times with my co-founder, James Wagner. We both met at the University of Idaho in the mechanical engineering program and just had an interest post-grad in electric vehicles. That started really our journey with an article in Wired Magazine talking about this fancy new startup company called Tesla Motors, founded by a gentleman named Martin Eberhard. The article was fantastic. Here's this great-looking electric car. It doesn't have to be weird looking. It's built on a rolling frame from Lotus. It goes zero to 60 faster than half of Porsche's lineup at the time.

It really was not out of this world expensive. We're thinking, “Oh, this is very exciting. Okay. This is really a big change in fundamental technology and how transportation would work.” You go online and all of the comments were, “I can't drive this from my one house in San Francisco to my other house in LA.” If that doesn't sound like a problem that you and I have, it's because I don't have any homes in California, or otherwise. That didn't really feel like a realistic problem. It set us off on a journey of trying to look at energy and the way that we consume it in a different way.

At the time, those issues with that vehicle were recharge time and range. So, we started a first company called R2EV, removable, rechargeable electric vehicle. That was in 2007. Took us a couple of years, we built some prototypes, we continued to eat ramen as if we were in college, with revenues off of our first job. We just kept that going for a little bit and started making prototypes, building different rapport in the industry. We ended up with a contract with Tier 1 Auto Integrator over in Spain. They had a contract with the Spanish government to build and assemble 12,000 electric taxis, with the one clause in there that it needed to be with a modular removable battery system.

Now you could think back at the time, 2008, 9, 10, there was another company called BetterPlace. BetterPlace did not have a modular battery platform. They had a singular removable battery. It ends up that the battery overextended from the vehicle platform they were using by a few inches, which is non-ideal if you're thinking about a battery structure not fitting into a car. They weren't willing to change their design for this application. We said, “Well, we're modular with these little blades and you can rack them into a Fiat Panda. Not an attractive vehicle, but generally pretty good at being a taxi.”

Ended up with this contract. Started working with the auto integrator. Then as we know the story in 2010, austerity measures in Europe, that actually voided the contract with the government. We thought, okay, well, we'll come back to it at a time that energy may be more interesting. We need costs to come down on lithium batteries. Well, they did. We re-reviewed what we were doing and thought, let's start a company again. What would we change? Well, with R2EV, those batteries all had to rack into a specific predefined bus. That could all be a parallel bus at 48 volts, or a series bus, and so, you could increase your voltage to drive your vehicle, multiples of those to add range.

We thought, we can't do that. We can't have a predefined bus all the time. This needs to be an energy platform and a framework. We integrated that bus system and started filing for IP. We have a stackable battery platform. We started that very early on, started filing for IP in 2015 in research and development mode, basically, just trying to come up with a concept of how can we turn a battery into a fuel source? It needs to be functional and ubiquitous and can do all sorts of things. Here we are doing that today from small scale to large.

Bill Derasmo:

And so, when you say it's a stackable battery system that, I'm just reading from your profile, it's a stackable battery system that allows the customer to create the perfect solution for their power problem. Are you mainly in the mobility space, or the stationary storage? What sphere do you see Joule Case playing in, or both?

Alex Livingston:

Actually, the way we like to look at it is digital fuel coined here first, right? Digital fuel is how we look at this approach overall. Whether it's a high-octane fuel source to run a jet engine, or it's 89 octane to run your weed whacker, or your old Toyota, there's a fuel platform that we all know and understand in the combustible market. We're trying to create the same experience with electric applications, whether it is powering a generator replacement, whether it is in mobility, or whether it is in more advanced use cases where we're able to store this energy and use it in

really interesting ways. It's always a fuel source. If we treat it that way, we can do really interesting things with it and it helps people to conceptualize what it is that we're doing. It is a storage platform as a fuel. If we can help them with that, that's what we're trying to accomplish.

Bill Derasmo:

Storage platform. What is your battery chemistry?

Alex Livingston:

It goes to battery chemistry and say, well, all right, if you have different cells, they all run at different voltages and how many of those do you have in series? Then you make a pack and you make a module. Are you putting more modules together to get to this? That becomes a really tricky thing to try to understand and to try to manage. If you think about jump starting your car, it's 12 volts. We have a very small voltage difference. Even just that voltage difference creates a pretty big spark. Obviously, it's the current and the amount of power in the energy discrepancy. Just that voltage difference alone can be a problem.

And so, we've designed a system that we match voltages across different platforms. Chemistry is really agnostic to us. We do this today, we use NCM, we use LFP and we're studying the application of sodium for a variety of our different technologies, where we don't need as great a mobility, but having these portable systems is probably key to scaling. We're able to use any technology that's out there, and we match this with DC-DC converters to create that digital fuel.

Bill Derasmo:

Digital fuel. I think that's going to be a new phrase for the audience. Maybe dive into that. What exactly do you mean by digital fuel? Because it's a new term for me as well. I think this is about my 36th podcast episode in this space. The first time I've heard someone use that. Maybe you could elaborate.

Alex Livingston:

Well, it's great that it's new, because we think we've invented it. It's great that this is a new experience. Really, it's that concept of if you have a 48-volt platform, now you're stuck into a 48-volt platform. Once you go into higher voltage, there's a huge range of voltages that you can expect to encounter. Whether you're trying to power an inverter, receive power from a charge controller, drive a vehicle, charge a vehicle, or whatever it is that you may encounter, coupling additional batteries together, you need to have a fundamental commonality.

What we've coalesced around is to describe this as a digital fuel. Intelligently, we established communications between a DC-DC bidirectional network. We can now pass power across that entire network. Picture a battery system that maybe its native voltage is around 700 volts for its pack. We have an inverter that would prefer to operate at 900 volts. We have another battery system that its battery voltage is maybe 1,200. By using these DC-DC converters, we can match to a common fuel framework and move that energy as if it's all the same thing. That's

what we're trying to accomplish is to make that seamless and easy for you. You just need to know that there's some energy that you have and you need it to do something else for you.

Bill Derasmo:

Okay. Interesting. Interesting. Okay. Let's go into my world a little bit more. We talked a lot about the mobility space from time to time in this program. I think anyone who's listened a lot knows that my heart is closer to the stationary space and the grid scale space. How could Joule Case work with a stationary application, a grid scale application?

Alex Livingston:

Well, we have a number of grid scale applications that we have out in the market today. These are facilities backup where we're doing the common typical thing. It's peak load shaving, demand response applications. Now, we're working with groups where when they're installing a large piece of equipment into manufacturing, we actually provide a buffer for that specific piece of equipment. These are harmonics issues that may come about when they're trying to couple up a large dryer, or ozone machine in water treatment, they now have to sign a number of agreements with that manufacturing partner when they go and install this piece of equipment to say, everything that we connect up to all to the common point of connection before it goes back to mains, we guarantee that there won't be a problem there.

Now, it's difficult to guarantee that when you have big electric systems that come online, being able to ensure that you're not having harmonics and frequency issues. We're seeing this a lot with charging going on across, did you do proper balancing throughout the phases, throughout your parking lot? Are they all coming in on time? We can do a lot of load shaving and management of those harmonics through a stationary system. Again, by using this DC-DC platform, we can remove a lot of that.

Bill Derasmo:

I would imagine, it would be important with data centers.

Alex Livingston:

Hugely. This is one of the things with AI right now that it is creating an unknown for grid operators and one of these big boogie men in the room is do we need to double, triple, quintuple our grid capacity to match some of the power applications that we're seeing with transportation electrification and home heating electrification. Data centers are a big unknown. We do see quite a bit of that, but these data centers haven't moved too quickly away from just that fast transition and immediate peak load shaving. In many cases, they're still using lead acid.

Bill Derasmo:

Well, interesting. I mean, I think you ran through a lot there and I'm just curious, because I think it brings together a lot of things. I think a lot of what you're talking about, it would implicate the amount of capacity that we need on the system overall. I think what you're saying, maybe I'm

mistaken, is we may not need as much capacity as people think if we use some of the technologically advanced devices, such as what your company has developed. Maybe, I didn't say that all that great, but I wanted to get your thoughts on that point.

Alex Livingston:

Bill, I think you nailed it. The way that we look at this is we already have the production, the transmission for peak loads. Let's look at how we're actually using that energy and if we can, it's not just as simple as put a battery somewhere and it will manage itself. If we look at where these applications are, we look at the different businesses, in ACIS classifications for those businesses, we can look at their power profiles and we can find capacity overflow. If we can grab that capacity, it's now a bandwidth issue, and it's bandwidth at the time that you need it and being able to have energy storage to solve some of those needs, maybe, and this is what we believe, we will not need to increase capacity in terms of transmission, or in terms of production on demand.

If you're a utility operator right now and someone says, in the next 20 years, there will be 380 million new electrical devices, the kind of which you've never seen before demanding huge amounts of power for you, you say, the only way I have to solve this is to add more production and more transmission. Because I know you're going to want your power right on demand and we can't produce it in you.

Bill Derasmo:

Right. I mean, that's the big elephant in the room, right? Within the electric industry, electric utility industry and among the system operators is that we keep retiring dispatchable resources for various policy reasons, right? Carbon reduction, etc. You have all that. I mean, to begin with the inertial response goes, because then you have trouble with the ancillary services and voltage, etc. But then, you just have capacity issues and quick start resources when you have a severe winter storm, or some other event. When you retire, the coal and the natural gas, it becomes a problem. I think what you're saying though is that you can play a role here in getting more out of the existing resources on the system, but just using them in a more smart way, or a more efficient way, I should say.

Alex Livingston:

Yeah. Smart and efficiency. If technology is not making your life easier and it's not improving what we already have, it's the wrong thing. Technology probably isn't the word for it. In this case, if we look at a couple of quick numbers, in the US total consumption and this is paid for consumption, what we're able to gather in terms of data is 4,200-ish billion kilowatt-hours. Why do I put it in kilowatt-hours? Because that's a number that we're used to thinking about. Then when you make it 4,000 billion, I could say, 4.2 trillion, but then that starts to get unimaginable. This seems like a huge amount of consumption.

Bill Derasmo:

What about terawatt-hours, right?

Alex Livingston:

Right. It turns into terawatt-hours. That's really a hard number to start to get your head around. We can start to break that down a few ways and we can look at, okay, well, if it's in hours, how many consumable hours do we have across a year? Well, there's 8,760 hours consumable in that year. Then we can start to break things down a little bit further from there. Let's also look at what our total production and transmission capabilities are in the US. Well, that's 14 billion kilowatt-hours if we multiply it out to that time.

We have an extra ability in a year to create another 10,000 billion kilowatt-hours. That's more than double what we're needing right now. Say, okay, all right. Well, if we know we've consumed this 4,000, 4 terawatt-hours and we can make 14, what can we do with that extra 10? Can we make it less expensive and transmit that? Well, we think that's where the duck curve is. We think we can bring in more renewables during the day. As it turns out, that's typically when a trough is. Let's utilize that capacity. Say, well, energy storage is very expensive. It's probably more expensive to use energy storage as that medium than to just increase our total production.

Well, it turns out, it might not be when we're looking at bringing up these additional transmission and production capabilities in the terms of trillions of dollars, right? That was something that was approved in a bipartisan legislation. Was it 3.4 trillion dollars that was approved?

Bill Derasmo:

I'm not sure, to be honest.

Alex Livingston:

Huge amounts of money to be able to improve our aging infrastructure. Now, there will be things that we naturally have to upgrade, but we don't necessarily need to triple, or quintuple that power production, if we look at it this way. Then you say, okay, well, maybe we need to understand what the full impact of these electric vehicles could be. Again, we go back and we think, all right, well, 280 million highway vehicles in the US, not including off-road, not including neighborhood electric, or neighborhood, but 280 million of those, if they all have about 100-kilowatt hour battery, just for simplicity sake, that's 28 billion kilowatt hours. That's the thing that shocks grid operators. Is that number seems like, we do need to increase five X to meet those demands. That's assuming those vehicles are running constantly all the time and they're never stopping and they will need to recharge completely all the time. We know that they just don't. They don't do that.

Another way to chop that down is how many miles did those highway vehicles drive in a year? Well, that's 3.2 trillion miles driven. Then if you start to say, well, we know how efficient electric vehicles can be for those miles, we start to get to a point where we can really understand that. If all of those vehicles in the fleet were sedans, efficient Tesla vehicles, that's only about 12 million kilowatt hours. That's one 1,000th of what we're looking at and having an overage. Now, this number seems not quite so scary.

Bill Derasmo:

What about, have you gotten involved with two-way charging? Because I'm thinking about all the electric vehicles and the possibilities there. I was wondering if you could speak on that.

Alex Livingston:

V to X in general is how fleets and how fleet and transmission is looking at this now. It's not just vehicle to home, vehicle to building, vehicle to vehicle, but V to X. When we're describing that, there's a great opportunity, I think, going, it's behind the meter. If we don't push that out, but as long as we can communicate that to the grid operator, that's a very effective way of doing these things. Having all of these grid tie capable inverters is going to over-bloat a vehicle system, in my opinion. If we're able to do things on a DC-DC way, well, we can just take that battery energy directly and we can multiply it out across a number of these and we don't have to have the extra cumbersome burden of AC transmission. Being a DC guy, I really prefer that.

Bill Derasmo:

Interesting. Yeah, let's talk about that, because we breezed over it. I didn't really drill into the DC-DC converter issue. Talk about how that distinguishes your company from some other models that are out there.

Alex Livingston:

Right. By the time we get to the point where we're moving lots of power, we do it with DC. This is all non-transmission related. But if we need to move a lot of power a short distance, we do it with direct current. We do that with vehicles when we fast charge them. There are only a few auto and heavy duty vehicle manufacturers that use AC. BYD is one of those, but they're already starting to make some moves where they're doing direct DC fast charging. Knowing and seeing and understanding what the voltage characteristics and behavior of a large battery system are, well, a DC-DC converter can just pull that energy out. We don't need to take it, put it into an inverter, bring it up to a grid tie capability, match that frequency, match those harmonics, make sure we're putting it in the right node. We can just pull it out and use it later.

There's a lot of advantages when we look at those type of applications. One of the main reasons why we design that system is we can pick a much higher voltage than an operating voltage of, say, 480. With being a low voltage transmission of 483 phase with five conductors, if I move my DC-DC converters up to, say, 1,200, with two conductors, I can move a lot more power with just the two conductors than five at 483 phase for the same amount of current. I don't have to worry about matching frequency. It's just exactly what the voltage is. There's a huge, huge number of advantages that can be met as long as we have the ability to pick the flavor of fuel output.

Bill Derasmo:

Interesting. Well, I'm glad you walked through that, because I had not encountered – in my travels on this program, the DC-to-DC converter. I appreciate that. I appreciate what you're

saying about the strength of DC and its advantages in the applications, I think you're talking about. Let's shift gears for a second. Let's talk about your company, Joule Case. Fairly early stage. I was going to ask you just your experience in terms of raising equity, raising money, what that experience has been like. Because obviously, you're someone who likes to get under the hood, so to speak, and build these systems. Just talk to me for a minute about the business side of things and how that process has been for you and your experience.

Alex Livingston:

Well, we are a team of engineers that as a founding group, and that can create some struggles. We were able very early on to bring in some capital and from our professional careers, James and I were able to bootstrap the company in early days, get to product and start running. We actually had orders that pretty much facilitated our whole first batch run with Joule Case. We were able to get going. We had right product market fit and we could get out there and describe this.

We were still early days though, in the consumer adoption of advanced battery systems to replace, say, a generator asset. It was fairly pricey when we first launched. We found a lot of market application with event production companies. Now we're starting to move further and further away from where somebody is comfortable saying, “I know and I understand this business.” We weren't quite consumer electronics. We fit into this other ancillary bucket of consumer related electronics, but in a very niche field. A lot of venture capital didn't understand that at the time. We were out raising funds through angel networks. That was a good process overall. We received a lot of help, great advisors getting things up and running. We went through the typical route and typically, got a little bit more money than what we were asking for every time. If it's there, go ahead and get it, bring it in. Don't too dramatically oversubscribe and dilute. We've done a very good job of that.

Then when it came time for our formal registered round, it was right before COVID. That decimated our opportunity to raise a formal round at that time. Not being in the valley or any of the other major tech hubs on either coasts, hampered our ability to do that. But we found a great champion platform within some of these crowd equity facilities. That is a register round. It was a very interesting way to go about things. I do think there will be a lot of evolution in crowd equity, capital raising. We had a great experience with it.

A number of those investors have reached out to us and said, “Hey, could I introduce you to my old colleagues at fill in the blank? I think this would be a natural fit.” Some of those are now our largest contract opportunities have come from that investor network, which is what you want out of having an investor and a big investor is to introduce them to your network.

Bill Derasmo:

Yeah. I see you use Wefunder, and I'm familiar with smart engine. I think there is going to be more and more money raised that way. You can raise millions of dollars through that network. It's just a different way of doing it. Now you've got individual shareholders, but as you say, to become part of your network. I will confess that I've invested a little bit of money through those vehicles, too, and it's an exciting thing for individual investors.

Yeah, I was just curious about that. It must have been an interesting experience. I saw that in the company profile and I think it's exciting for you guys. Of course, you've got your stake in it, because you're one of the founders. If you listen to past programs, I always like to ask founders of these various companies what that's like. I know that it could be probably a little nerve wracking, but it's also very exciting. I just wanted to get those thoughts on the program, because I think it's a unique part of the story.

Alex Livingston:

We've had an excellent time with Wefunder, and those investors – our investors overall in general have been excellent for us. You hear a lot of horror stories from other groups about having one particular – a couple that really sour you on things. We've had an excellent group of investors and advisors that have worked with us. One thing that's been very crucial and core to us is every single employee of Joule Case does get equity into the company. We wanted to make sure that people really own, literally, the process of being involved in clean energy and have a stake in it and get rewarded for those activities.

Bill Derasmo:

Well, the most sophisticated private equity firms in the world believe in that, right? Like, KKR, or some of these other big outfits. They like to see management and employees who own the company that they're going to get involved with, because they see that that's the best way to align incentives is if you give people stakes, give people some skin in the game. It's a tried and true way of doing it, for sure. For Joule Case, just talk to me a little bit about who's your core audience for this program, for who do you want to talk to about buying your product?

Alex Livingston:

I think the best application that we have right now and it's because of our mobility is if today, in any way, shape, or form, you or your business or some other portion of your business relies on temporary power for any application, whether that's bringing temporary power into your building, you're going out into the world and you're relying on temporary power, very commonly a combustion fuel source, construction, music festivals, things like this, you no longer have to rely on diesel. We've shown this over and over and over again for years that were a much more efficient system to operate on battery. You don't have the noise. You don't have the emissions. There are a huge number of things that we can solve that aren't even a part of the normal train of thought.

For example, stringing all of the cables for miles and miles at a music festival, because you can't put a generator right next to where people are trying to breathe. You now don't have to hide it. You can put that power device right up next to the stage. It reduces cabling costs, things like this. We're very, very good at replacing temporary power. That's right there. If we could talk to everybody that has a temporary power, and this is going from our work truck, food truck, so smaller businesses that are relying on temporary power for their daily operation on up to mining, or water pumping, things like this. We're very, very efficient at that with the systems that we've designed. But then, it's thinking about the next wave of what's going on with electrification.

What I would encourage, either fleet operators, business owners, at home consumers that are thinking about bringing electric vehicles into their lives, there isn't a lot of reason to go out and buy a charger, pay for infrastructure, go through the permitting process, trenching, laying all that copper. If you just have a battery system and you're trickle charging it and it has a DC-DC component on it, you can fast charge that vehicle and you don't need the extra component of having a fast charger. With our system, it's built in. You basically get it for free. We're beating chargers that are being installed in the ground. You don't have to worry about service capacity upgrades and we're a lot less expensive.

Bill Derasmo:

All right. Well, I appreciate you walking through that and I think the audience will hopefully appreciate it and start getting the wheels turning. It sounds like, there's a lot of applications potentially. I really appreciate it. This has been a unique program, I think for us. We talked to a lot of different parts of the industry that touch energy storage. We've done past programs that have hit on mobility, grid scale storage, second life batteries, etc., but I think Joule Case has been, and Alex, you've had your unique story to tell. I appreciate you being on the program today. I appreciate you taking the time. I'll give you the last word. Tell the audience what they need to know in terms of getting in touch with you, or getting in touch with Joule Case.

Alex Livingston:

I'm available on LinkedIn. Apart from having my new Santa Claus beard, do look like the guy that's on the profile. I am very inquisitive. I'm happy to hear from you and your applications concerning future energy needs. Our whole team is available. We design, manufacture, and we build in the United States. We have our small volume manufacturing out of Boise, Idaho, where I'm from. Then we're building up right now two manufacturing facilities in California and one in Texas for our larger Olympus classic products. Those are going to solve your transmission power needs.

Bill Derasmo:

Well, we didn't even get into that. I didn't realize that you've got three manufacturing facilities, and that's exciting stuff. We might have to have you on again to talk about the second half, which would be the manufacturing facilities and as you say, the Olympus class products, because now we're getting into transmission and that's now speaking my FERC jurisdictional language, where I'm sitting in the in the DC area here. We might have to do part two, Alex. We didn't dive into any of that, unfortunately.

Alex Livingston:

Bill, if you're up in the DC area, one of our new partners, Xylem has their reservoir headquarters right next in the Navy Yard district. Maybe we'll have an offsite meeting for this next podcast.

Bill Derasmo:

Well, if it's by the Navy Yard, we're heading into baseball season. I love baseball. We could go over to Nat's Park, we could have a beer and we could talk batteries and you could tell me about your Olympus class products.

Alex Livingston:

That sounds like a deal. Bill, thank you so much. Thank you, listeners. Appreciate it.

Bill Derasmo:

Thank you.