BATTERY & STORAGE PODCAST, S04 EP01, THINK ZINC! THE ENERGY DENSE ALTERNATIVE REPLACING LITHIUM-ION WITH SALIENT ENERGY COFOUNDER RYAN BROWN
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Bill Derasmo:

Hello, and welcome to the Troutman Pepper *Battery and Storage Podcast*. Today, my guest is Ryan Brown from Salient Energy. Welcome to the program, Ryan.

Ryan Brown:

It's a pleasure to be here.

Bill Derasmo:

Well, Ryan, you've got a very interesting background: Bachelor of Applied Science, University of Waterloo. But before that, you were originally a finance student. You're the co-founder of the company, Salient Energy. Why don't I turn it over to you? If you could just give us a little bit of your background, and then we can start talking about zinc ion.

Ryan Brown:

Thank you. My background, to give the short version, I grew up wanting to be rich, and so I enrolled in a finance program and I aimed for working in banking. It took me about one month into my banking internship to realize aiming to be rich wasn't a sufficient goal in life, and that sparked a quarter life crisis where I wanted to define a new career of meaning. Back in that time, this is how long ago it was, Elon Musk was a very credible and laudable role model, so I took a lot of inspiration from him in doing the hard thing, working on hard technical problems to commercialize solutions that would make a big impact. And that's when I decided to switch to engineering, and more specifically to focus on one area of technology that I thought would have major impact on climate change, which was batteries.

So, three years into my finance degree, I restarted, went back to engineering, back to the first year. And in that first semester, I said, "I think batteries are the future. I'm going to skip all my classes and go to the battery lab and just learn everything I can about batteries." Luckily, batteries did turn out to be very important, and now I'm fortunate enough to have found some really cool people in that lab who had some really great ideas. And that's what led to Salient Energy. But more broadly, I'm just super excited to be a part of this industry as it hits this inflection point of growth and there's all these exciting challenges that need to be navigated, but this huge potential payoff of actually building a clean, low carbon grid.

Bill Derasmo:

Appreciate that background, and then appreciate how you had the courage to switch out of your first choice, which was basically a finance degree, it sounds like, and then follow your passion. And now you've further followed it to help start a company, and in a space that really will have significant impact on issues like climate change, carbon reduction, and overall transformation of how we receive energy. With that lead in, maybe you could start with what led you to want to start a company that's focused on zinc ion batteries. I know as the

conversation continues, I'm sure that we'll spend some time discussing how zinc ion batteries differentiates from lithium ion, which is more prevalent in the market right now. But maybe we could start with: How did you decide, "I need to co-found a company?" Why don't we start with that?

Ryan Brown:

The opportunities to start this company came to me in the form of my co-founder, who I was working with in the lab, who found a new way to create a zinc battery that made it work like and look like and be built like lithium-ion, which had never been done before. At the time, thinking about how batteries would make a difference in the energy transition, it was really clear that lithium-ion was going to be the main technology for electric vehicles. And most people believed that the growth of lithium-ion adoption in the EV market would create the conditions where there was just more, better, and cheaper lithium-ion batteries for the energy storage market, and that it would be the solutions for both markets.

But at that time, it was clear to some people, and I was persuaded by this, that the raw materials used to make lithium-ion batteries wouldn't scale at the rate needed by the energy transition. And so, it seemed important to have an alternative technology that didn't depend on the same raw materials, that didn't depend on the same supply chain, so that you could have terawatt hours of batteries deployed for solar and wind, while terawatt hours of batteries are deployed for EVs without exhausting the world's mining and processing capacity. And so, because the technology came to me where it was basically a lithium-ion battery without needing lithium, nickel, or cobalt, and we were at this point where that seemed very important. I couldn't say no because I thought that this technology could make a big impact if we brought it to market.

Bill Derasmo:

Talk to me then about zinc. How did you guys land on zinc ion? I totally understand based on a lot of conversations with either people in the market or on this program previously, about the early dominance of lithium-ion, but also, all the issues that come along with that, as you quickly summarized them. So how did you guys come to zinc?

Ryan Brown:

Yeah, great question because it actually was ignored for quite a while. First thing to understand is the background beliefs in battery research. Until very recently, battery research was guided by making batteries for electronics, then making better batteries for electric vehicles, and that always focused on making a really light, compact battery. And so, everyone always qualified technologies based on the amount of energy they store per weight. And zinc is not a good candidate technology for energy per weight because zinc's pretty heavy. But what actually really matters for cost is how compact it is because that determines how much energy you can get in a small device for low cost.

And zinc, when you make a zinc battery, you get a lot of energy out of a small amount of zinc metal, so you can make a really compact battery. But it would be a heavy battery, and that's why it had been completely ignored. So, we were looking at zinc because it allowed for the use of really inexpensive, abundant metals. It allowed for making a compact battery design similar

to those used for lithium-ion, which allows for using the same manufacturing as lithium-ion, which is really key to being able to say that a technology will be able to scale up quickly and inexpensively.

And then lastly, zinc is the ... This is a bit chemistry wonky. Zinc is the first metal on the periodic table that's stable in water, so if you want to make that compact simple battery, you want to just have a clean piece of metal as your anode, and if you want to make a safe, easy to manufacture, low cost battery, you want to use water. So, if you want to make a water-based battery, zinc's your best bet. So that was kind of the first principles thing that led us from a chemistry perspective to zinc, is we wanted it to make a water based, safe alternative to lithium-ion that would still be able to use the same low-cost manufacturing, and then use abundant materials, and that's what took us to zinc.

And this isn't new, zinc batteries have been around forever. Actually, the first battery that has been invented is zinc. But what my co-founder's different approach enabled was being able to recharge it thousands of times and make it perform like the lithium-ion batteries that are currently used today, before zinc ion batteries were cheap and safe and all those things, but couldn't really be recharged. And if they were designed for recharging, it was for dozens of times, not thousands of times.

Bill Derasmo:

Let me hone in on one thing that you said that zinc is heavier, but it can be very compact. So where does that lead you in terms of the battery? When I think about the battery world, and maybe you think of it differently, and that's fine, we can talk about that too, but from my end of the elephant, as they say in the legal world, I think of, okay, we're going to talk about batteries. The first point of demarcation is: Are we talking about EV or are we talking about utility scale, grid scale, stationary, as they say? So, let's start with that. The impact of that phenomenon of zinc being heavy, but very compact, but energy dense. And then where for your company, Salient, do you see it fitting in, in that dichotomy of EV or stationary?

Ryan Brown:

Yeah, good question. Absolutely, we are very focused on stationary energy storage, more specifically, two to eight hours of storage, so intraday, which is referring to the use case of shifting solar from the afternoon to the night, or doing a few hours of storage. Why that, and why not EVs? For EVs to have range, your battery has to be light, zinc can't be light. And honestly, there are few technologies that can even theoretically beat lithium-ion in how light it is, and practically, it's basically just lithium-ion. So, no one's going, in my opinion, going to replace lithium-ion for batteries that have to move. But since the batteries don't have to move, what actually matters is: Can you make an easy to adopt, easy to install, low-cost, high-performance battery? And that's what the compact nature, the energy dense nature of zinc allows, even though it's twice as heavy.

Bill Derasmo:

When I was thinking about it, I thought that's what the answer was, but I just wanted to make sure because when you think about energy dense, it's heavy. You think, "Okay, then it's going to be on a stationary side, on the grid scale side," and that's more of what my language is

anyway. That's interesting that you're looking at a two to eight-hour window because I think a lot of times with lithium-ion, as I understand it, it's more like two to four hours. And of course, battery use cases, you can customize the installation to meet a variety of needs. But a lot of times, you're talking about, say, a four-hour window at the peak use case, if it's going to be energy, they can provide ancillary services as well, primary frequency response, those sorts of things.

But for the two to eight-hour window, then it starts to sound more like a long duration case, or a mid-duration case. And I've picked up, at least anyway, in the market, an increased interest in those use cases for people who would be interested in deploying battery storage. I don't know if you could speak to that. But I think the two to eight-hour window is interesting. And I want to click on that, so to speak.

Ryan Brown:

Yeah. When I say two to eight, we're anticipating the typical use case, the average duration is four hours. And more qualitatively, we're making our battery to do the same thing that lithium-ion batteries currently do, and basically are planned to do in the energy transition, which is shift energy around for a few hours at high energy efficiency. And that's contrasted, as you noted, with long duration storage, which is people solving for the problem of outside of within one day cycling of charge and discharge. How do we make something that can address a few days of low energy supply, or seasonal, or things like that? And those are just a different category of technology, so since our battery looks like, performs like, is basically the same as lithium-ion system, but just safe and uses materials that aren't in shortage, we're just making something that from a user's perspective, is the same as a lithium-ion battery.

Bill Derasmo:

I appreciate that clarification because I obviously misunderstood that maybe you were talking about a longer duration case. But if it's a four-hour, then now it really drives home the point that you guys really view yourselves as a substitute for if a company was looking and going out and deploying batteries instead of them having no other alternative, but then to turn to a lithium-ion battery energy storage system, they could come to you. And you could provide that substitution, if you will, and I guess the advantages ... You can talk about this, but I'm just thinking that the advantages are probably, one, safety with the zinc ion, and use of water. You don't have maybe the fire risk that you have with lithium-ion. And then maybe another advantage is that you're not dealing with rare earths, as you would with lithium-ion, cobalt mining, those sorts of things. And then finally, I'm sure there are other advantages that you'll point out. But the sourcing, and that you can do more of the sourcing in North America, or United States in particular.

Ryan Brown:

Said it better than I could myself.

Bill Derasmo:

No.

Ryan Brown:

Yeah. So, I think because everyone believed lithium-ion was going to fall in price 10% year over year, they were just going to be better, cheaper, and more abundant. The entire industry is basically oriented around building the systems, building the architecture, building everything around these modular lithium-ion batteries. There's not many technology available to replace that if lithium is in shortage, and that's what we see now, where people who assumed batteries would always be available and they'd always be cheap, suddenly the costs are rising 30%, 50%. If a president decides to spark a trade war, suddenly they can't get the supply at the price they want. And overall, the industry's becoming more concerned, the industry being stationary energy storage, about how it's going to secure a reliable supply of high-quality batteries when they're competing in a fiercer and fiercer competition with the auto makers, who always win the bid because they have orders of magnitude higher purchase volumes.

So, we want to be the industry standard supplier for stationary energy storage because we know that with our supply chain, that is completely separate from lithium-ion, is domestic. We primarily use zinc and manganese. Both are mined and processed in abundance in North America. We can create a secure, reliable supply chain. We can be the supplier that's going to prioritize the needs of the stationary energy storage market, not switch to BMW the second we can. We offer safety because, as you said, our water-based battery, no chance of it catching fire, no matter what you do.

This is what we've proven with UL testing, which not only adds peace of mind to the user, but way simplifies permitting, certification, installation, and just makes getting these batteries in quicker and easier with less concern along the way. And then being able to provide those benefits in a form factor that the customer already uses and is comfortable with. That's what kind of makes it all tie together. And then of course, now that the Inflation Reduction Act has been passed, being able to show people that we have a domestic supply chain from mines to modules is a good way for people to start planning on this new de-globalized world.

Bill Derasmo:

It's really interesting to hear you go into all those points. And I'm sorry if I previewed, but no, I think what I'm picking up in the market is some of the problems that you talked about with respect to lithium-ion, I'm not even talking about the fire risk, just the competition with the OEMs, and for the uninitiated, the auto industry, basically. As that pressure on the auto industry increases to up the production of electric vehicles, I read in the *Wall Street Journal* yesterday that 10% of auto sales in 2022 were electric vehicles, which I understand that's still 90% internal combustion, gasoline, whatever. But that's a big jump from probably 2021 to 2022. And it's only going to get a higher percentage as California and other states kick in with their requirements on how many cars need to be produced and on that road that are fully electric.

So, with all that said, that's a good point about where the market's going. And the market for lithium is only going to become more challenging. I think we can all agree that lithium-ion batteries are here to stay in the dominant position now. But the challenges are already here, I think in certain respects. I think you set that up well. What I would lead into, and you talked about domestic supply a little bit, you alluded to zinc and manganese being abundantly mined in North America. Well, there's the Inflation Reduction Act. And we've, on a couple of recent episodes on this podcast, talked about it. And obviously, it's just been ubiquitous in the news and the storage industry is greatly impacted for a variety of reasons in a positive way. I was

just going to ask you if you could talk at a high level on the impact that the Inflation Reduction Act has had on Salient Energy, and where you see everything going.

Ryan Brown:

It was transformational. We had spent so long talking about supply chain, the importance of being able to use domestic supply chains, the value of us being able to say, "This zinc started in Alaska, got smelted in Quebec, made its way into the battery," and we know the emissions and human rights traceability all along that. That, for us always had a lot of value. But the Inflation Reduction Act put a dollar figure on that, that's pretty high, which has basically changed the game. I think because the details of the Inflation Reduction Act are still being sorted out, there's kind of two ways things can go.

The energy storage industry uses lithium-ion phosphate lithium-ion batteries, LFP, and if the Inflation Reduction Act gets a lot of those batteries produced in the US, and those new battery producers, while they're doing a few years of qualification testing with the auto OEMs, are selling their batteries into the energy storage market, it could lead to a short-term supply of American LFP, costs would be higher. But then, the tax credit would reduce it. So, I think there's one way in which the Inflation Reduction Act could play out where it spurs a lot of domestic lithium-ion production. But the other way it could play out is if the demand from OEMs just outpaces how much domestic batteries are produced for them, which given aggressive moves by California, all the things leading to massive increases in demand, and just how hard it is to stand up new battery manufacturing.

Just this week, one of the major lithium-ion battery manufacturers in Britain, Britishvolt, went bankrupt because it's not easy to stand up these operations. If that domestic production can't keep pace with the rapidly growing and accelerating growth from auto makers and the energy storage industry, then we'll be really well positioned to be the only alternative to Chinese supplied LFP batteries.

Bill Derasmo:

We've talked a lot about lithium-ion batteries, and even the production of those batteries in past programs. I think one aspect that I always like to mention is there is the second life phenomenon, which in part was aimed to try to address some of those supply issues. So, in fairness, there is that aspect to it. But the growing demand is so high that companies that we've had on before, like BTU Storage, or people like Megan O'Connor, who are with Nth Cycle, who are working on that second life issue, it's a question as to how much they're going to be able to address it by essentially recycling old batteries and using them on the stationary side. The demand seems so overwhelming for lithium right now that I think it's fair to say that there'll be room for everybody, so to speak. And there'll be room for your zinc ion approach, which just sort of bypasses the problem altogether.

Ryan Brown:

Yeah. I mean, I love our technology. But it's going to be an all hands on deck approach to solving the energy storage problem. A note I have on the second life use case, I think it's going to be part of the solution, but if you look at the volume of batteries delivered to the EV market from 2015 to 2020, and the volume of batteries delivered to the global stationary energy

storage market from 2020 to what's expected for 2025, it's the exact same numbers. So, the energy storage markets demand is the same and growing at the same rate as the EV market was, but shifted five years.

If EV batteries last 10 years, then the second life batteries can't be a major part of that demand just because that timeline doesn't match up. We need something to replace lithium-ion in the industry to continue to fuel its rapid growth. And that has to be an alternative to lithium-ion. And of course, there's going to be lots of solutions, but what we know is that when one solution works, once its performance is credible, once people can finance it because there's an operating history, once that technology reaches scale, there is a convergence around one known, credible, trusted component that dominates the industry and becomes what the rest of the players build around.

Bill Derasmo:

Well, that's probably a good lead into what you've got planned for this year. Why don't we talk about Salient a little more, and where you are in developing the Salient battery, and what pilots you've got in store for us?

Ryan Brown:

Yeah. As scientists, we started the company wanting to address the biggest scientific challenges, so things work in a paper, but you've got to make them work in an actual product, something that could be commercialized. That required us to solve some tough challenges around recharging when you make an energy dense cell. And that resulted in us making our commercial prototype cells, which are pouch cells, 20-amp hour pouch cells, look like and feel like lithium-ion batteries. We submitted those for UL testing to show that they're safe. We did the cost modeling on them to show that they're very competitive. And so, we ended last year with a very good lithium-ion replacement cell design.

This past year, we focused on scaling up the production of that, getting to the point where we could make 100 cells a week, so that we could make our first systems. Our belief as a company is that if you want to get to the market quickly, you have to own your product and work directly with the end user, so we're making a residential energy storage system that we can get directly into deployment by working with the right segments of the market, where it's the same size, it looks as good as a power wall, it looks like and feels like lithium-ion based energy storage system, but made with a US supply chain, lower carbon footprint, and completely safe. And so, this past year, we build that first power wall. We showed it works. We showed that we can build them the same way as any other, I shouldn't say power wall, residential energy storage system, but in that category.

We showed that we can build a competitive product. And this year, we're working through bringing that residential energy storage system to market and have our first in field pilots scheduled for Q four of this year, where we're working with a net zero community to install our systems alongside lithium-ion systems and show how they stack up.

Bill Derasmo:

So, in my parlance then, that would be a distributed energy type model. So, you want to go right to the retail customer level, the house, store, building, whatever. You're going to install your energy storage system at that level. Is that right?

Ryan Brown:

That's where we're starting. We're working closely with Terry Horton. He worked with his brother to found D.R. Horton, which is the largest home builder in the US.

Bill Derasmo:

Sure.

Ryan Brown:

And he's been advising us on how to work directly with home builders who are building net zero communities, so that we can have big customers that are really future focused, sustainability focused, and get systems out. So that's where we're starting. How do we make the best energy storage system for new build homes that are trying to integrate this distributed energy management model as part of their building? And the reason we're doing that is because if you try to start right in the utility market, your first sale is going to be massive in terms of volume, and bank-ability is a way tougher challenge. But if you start with residential, you can get more units out quicker. And the primary concern is: Are you going to be there when a blackout hits? Are you going to not set my house on fire?

And so, it's kind of like the Tesla approach to building cars. So, this residential model is our Roadster. It's going to be a great, flashy, pretty, all that, and then as we kind of work up getting our volume and performance record, that allows us to unlock new markets and achieve new levels of bank-ability, we will get into those larger volume utility scale projects.

Bill Derasmo:

I'm glad we got into that because it's a good way on this program for you to distinguish Salient from some other companies. You've got a very specific path in mind and I think it's interesting. And I haven't really heard that story before, to be honest, so I think it's a good one. And it should also lead into, because you mentioned bank-ability, so I've been kind of saving this one. But why don't we talk about the finance piece a little bit? You have that in your background, as you pointed out. That was kind of your first language, more on the finance side. And then merging your two parts of your academic background, the finance with the applied science and getting into the battery space. How have you approached your capital raises? And have you had any thoughts on where you're going on that front?

Ryan Brown:

We've raised over $10 million from public and private sources. To be really focused on getting the chemistry and the manufacturing right, what we've seen a bit in the market to date is people trying to do too much in parallel, a little bit over-promising solving science challenges as they're committed to delivering a product 12 months out. And that results in, I'd say, some unmet expectations. So, we've been really focused on sequencing, get the science right, get the

core cell right, get the manufacturing right. Get a product right, and then scale that production of that first product that has good margins that you can get at a small volume. And then go to higher scales.

This year will be focused on taking our residential product that we know customers want, that we can show has really good fit. And how do we scale up the first several million dollars' worth of sales for that product, so that we're a standalone, good commercial company? That's our approach. I think that's from a finance perspective, the right way to do things because the credibility of the technology is the toughest problem in this market. To finance the big projects, it's 10 plus year timelines, and you need to be able to create confidence that you will exist as a company for that timeline, and that your technology can last. And so, we know that's why we can start with the smaller volume, get those in the field sooner, get that track record established.

Do that in parallel with deep long-term testing because you've got to start the clock on qualifying yourself for the volume deliveries, and that clock's multiple years. Being able to serve a market, continue to become commercially successful, continue to grow, as you're establishing that track record for bank-ability is, in our mind, the right way to get there versus if folks are focused first on the utility market, then we have to spend all that money, build the factory, get all of the ability to serve that market. And then they've got to spend a couple years before they can get substantial sales. And I think the key difference there, it's not like we found this neat hack. That's just because our battery looks like and feels like lithium-ion batteries. And more specifically, it's as compact as lithium-ion. We can put our system in someone's garage, but other systems that are 10 times the size, they just won't work for anything except utility scale. So that's kind of our approach and the reasoning behind it.

Bill Derasmo:

Makes sense, and it seems like you've put a lot of thought into it. Let me ask you because I'm really interested, I always like to ask this type of question. The points you're making about ... And again, it sounds obviously, I would think you've spent a lot of time thinking this out with your colleagues. But what's it like when you go in for that pitch meeting? You've got your idea. Maybe you've got your pitch deck, whatever other documents you put together. And you go in to try to sell your idea to the finance community. It's got to be a nerve-racking proposition, so just from a human perspective, Ryan, if you could just speak to that.

Ryan Brown:

Yeah. It's a very funny experience just being a founder generally. Our company was founded based on the assumption that the cost models for lithium-ion batteries were wrong. Everyone said by 2023, lithium-ion batteries would cost 80 bucks a kilowatt hour. And we're these nobodies from Waterloo, but we think it's actually going to be much higher than that and costs are going to plateau. Psychologically, it's a bit weird to have to go into a meeting and say, "Hey, everyone else is wrong." It's especially psychologically difficult for Canadians be we are trained to be polite. You have to have deep conviction in your thoughts. You have to have really strong analysis. And you have to be able to really make the case why you see something other people don't, and that's tough.

For the longest time, we'd go into those meetings and we'd say, "Everyone's wrong. Lithium-ion batteries are going to plateau. There's going to be this supply chain crisis." And people are like,

"Yeah, okay. You're crazy. I've seen enough colleagues bet against lithium-ion and lose everything. Thanks for the chat, but bye." I think so much of doing a startup is just timing because now that the lithium-ion price has, I think it's quintupled in a year and hit five all-time highs, now our story kind of tells itself, and it's shifted to just a discussion around: How are we going to get there? How are we going to succeed? What are the details of that?

And so, my general advice for any other people wanting to do that is have deep conviction in the analysis supporting what you're doing. Be bold in sharing that and sticking by that. And then wait around long enough to get lucky because if you're right, eventually that will become true. Stick through the tough part of zagging when everyone else is zigging because it eventually pays off.

Bill Derasmo:

That's an inspirational piece right there.

Ryan Brown:

Thank you.

Bill Derasmo:

I like it though. Good for you guys in sticking with it. It seems like what you've been saying, you're starting to be proven correct, or you have been proven correct. I just know from talking with other people, not only on the podcast, but just in my work life here at the firm, when you have to present that pitch deck, it's a nerve-racking experience. And I always like to ask that type of question, and I appreciate you sharing that. When you look back on it, it's probably some good war stories, but sounds like you're moving into the next stage, so to speak. 2023, you're shooting for Q four for your pilot delivery, so that's all very positive. And appreciate you being on the program. I'll give you an opportunity, if there's any last things you want to say for the audience, if not, we can kind of leave it there.

Ryan Brown:

Yeah. First off, thanks for having me. Second off, for people who are interested in getting into this industry, I cannot recommend it enough. It's hard work, but it really feels good to be a part of the solutions to climate change, even though my first language is finance, and we've got to talk about how we're going to build a successful, profitable business. Every day, day in and day out, what we care about is: How are we going to accelerate the transition away from fossil fuels? And it's hard to put a value on being able to go into work every day, working on a mission you believe in. And so, for anyone who's listening to this podcast, and is thinking about getting into fighting climate change as a career move, it is the best decision you'll ever make, and I encourage you to do it.

Bill Derasmo:

I love it. I love it. And I appreciate you being on the program today. I really do. I know you're very busy. It seems like it's been a busy start to 2023 for everyone. But really, very interesting discussion today, Ryan. Appreciate you taking the time. And we'll leave it there, so appreciate

the audience for joining us for another season of the Troutman Pepper *Battery and Storage Podcast*. And until next time, thanks.