Battery + _Storage_ Podcast — Creating Solid-State Solutions: Todd Crescenzo, Clear Creek Investments and Jorge Diaz Schneider, ION Storage Systems
Hosts: Bill Derasmo and John Leonti
Guests: Todd Crescenzo and Jorge Diaz Schneider
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Bill Derasmo:

Hello, and welcome back to the Troutman Pepper Locke *Battery + Storage Podcast*. I am your host, Bill Derasmo, partner at Troutman Pepper Locke. Today, I am joined by my co-host and my partner and colleague, John Leonti. He will be making my job easier today as he will co-host this episode. John and I are sitting down with Todd Crescenzo and Jorge Diaz Schneider, both of whom wear many hats for companies like Clear Creek and ION. And we will give them a chance to introduce themselves and introduce their companies. But before we turn to Todd and Jorge, why don't we give John, my co-host, a chance to introduce himself and his practice?

John Leonti:

Thanks, Bill. Todd and Jorge, thanks for joining us today. John Leonti, based out here on the West Coast in Los Angeles. I'm a project finance lawyer, and I've had the opportunity and privilege to work with Todd over the last several years on several investments. And so, excited that we get the opportunity to talk to Todd and Jorge about one of my favorite topics, batteries and battery storage. Looking forward to this conversation.

Bill Derasmo:

Thanks, John, for joining me today and making my job a little bit easier. All right. Well, why don't we turn to our guests? I don't know, Todd, if you want to go first, and then Jorge? And love to hear about your individual careers, and then Clear Creek, ION, and whatever else you guys want to talk about.

Todd Crescenzo:

Absolutely. Thanks, Bill. Thanks, John. And thanks to the entire Troutman Pepper Locke team for hosting Jorge and I. As John mentioned, we have been attached to the hip, Troutman Pepper Locke and Clear Creek Investments, for a number of years now, and just excited to be doing this with you all. So, thank you.

Just a little bit about myself, Todd Crescenzo, Managing Partner at Clear Creek Investments. And what we do at Clear Creek – and then I'll turn it over to Jorge. But Clear Creek, we're a California-based investment manager. We focus on three critical but resource-constrained sectors, food, water, and energy industries and sectors. And we invest through a lens of innovation and sustainability as a multi-stage investor and actually as a crossover investor. We

invest out of one fund. It's an evergreen fund across those sectors and companies with deep technologies driving innovation in those sectors.

And so ION Storage Systems is a portfolio company. It represents as early as we invest. We were fortunate to co-lead their series A about 3.5 years ago. And the company has now matured 3.5 years later and is entering a series B stage. But really represents a company that was at a commercial inflection point that we could underwrite a roadmap to, be an engaged investor as board members, and solution providers to being accretive to that journey, right? And so I'll speak the investor speak over the course of this podcast. And, really, Jorge is the leader of ION Storage System doing the hard work. And so we appreciate that. But we're there to be solutions-oriented as an engaged value ad investor. With that, let me turn over Jorge. But again, thank you, everyone, for having us.

Jorge Diaz Schneider:

Excellent, Todd. Thank you. Bill, John, delighted to be here. Jorge Diaz Schneider, CEO of Ion Storage Systems. E-mobility veteran, which sounds strange when you say it like that. But I have been in the e-mobility space for more than a decade. And jumped at the opportunity to lead this amazing company after four years with Albemarle Corporation where I led the advanced energy storage materials global business unit.

Albemarle, of course, the largest lithium provider in the world, hired me basically to look for downstream lithium opportunities. Basically, materials that are beyond lithium hydroxide and carbonate in the battery space to power these next-generation batteries, including solid-state.

And the reason I came to ION is quite simple. ION wasn't my customer, and they were never going to be my customer because the solution was elegantly simple and came just with tremendous amount of pragmatism and technical elegance. And I couldn't wrap my head around it, if I could be completely honest. And so when the opportunity came around, I did not think twice, because I had spoken to the majority of the startups. And each one has its own merit. Each one has been focused on either specific segments and has kind of done very well working around some of the technical complexities that is a solid-state battery.

ION struck me as being really a tide that lifts all boats. It is a technical solution that is decisively focused on the anode, and it can be deployed to basically any type of battery architecture. And so that was really core to the purpose. That has always been our adventures in batteries. And so I was delighted and quite humbled to get the opportunity to lead just an amazing group of people.

Prior to Albemarle, and the reason why I call myself a new mobility veteran, is I have been in this since 2013, and I helped the specialty chemicals company known as LORD Corporation at the time. Now Parker LORD, since the acquisition by Parker Hannifin in 2019. It was very nimble, tremendously innovative company. And I helped them dive into the e-mobility space and help commercialize their set of thermally conductive resonance and adhesives. Delighted to be here. And looking forward to the conversation. Thank you for having me.

Bill Derasmo:

Well, thanks for that. And why don't we dive in with ION? It sounds like it was a no-brainer for you to go there. And it sounds like ION has a way to differentiate themselves. Why don't you talk about that and give us what makes ION special in the marketplace?

Jorge Diaz Schneider:

I would say there are three things. Let's describe the technology first. ION is a ceramic bilayer. It's a solid-state electrolyte that, again, is part of the anode solution. And what it is, the concept of bilayer is critical because there are other anodeless technologies out there. Here comes your first misnomer. When we say anodeless, it's basically saying there is no lithium metal in the form of lithium metal in the anode of the battery. And so, basically, the lithium plates as lithium metal as the cell charges, and it deflates as a cell discharges. All your lithium is in the cathode. There is no lithium metal anode on the anode side.

The bilayer concept is important, because if you take an anode-free battery under those terms, there is only one layer, one dense layer. And what happens is when the battery charges, that lithium metal has to go somewhere. That is why the battery swells. Because when it plates as lithium metal on the other side, there is no place for it to go other than to expand the battery. In a recent article, the folks from Mercedes described it as the battery breathes, right? It breathes when you charge it, and then it exhales when you discharge.

The bilayer is critical because what it creates is it creates a micron-level porous layer. You can think of it as the geometry where that lithium is going to expand is fixed by that bilayer, and it is also optimized. You basically pair the thickness of that bilayer to the amount of lithium that you have on the cathode. And, therefore, now you have a fixed geometry. The cell does not swell. That is the advantage, number one, the technology.

Advantage number two, this is a ceramic. And, yes, there is material science behind the ceramic. But at the end of the day, consider it a dinner plate, right? This is not a lithium metal anode that requires special handling. This is not any type of dangerous chemistry, like any type of sulfidic solid electrolytes, for example, which generate hydrogen sulfide when exposed to the air. That can be highly toxic. It's a very elegant technology in its simplicity in that way.

And the third aspect that I would add is that it uses materials that are already at scale by virtue of the other industries where they are used. If you think of a lithium metal anode battery, for example, in its pure form, lithium metal has been around for a long time, and it has been tried and tested. But it has been tried and tested mostly in primary batteries. If you think of a primary battery, it's a single-use battery. The secondary battery is a rechargeable battery.

And so an application there, for example, is pacemakers. The primary batteries that go into pacemakers, you put them inside people's bodies, that is a lithium metal battery. The problem is scale. Where we're going in the e-mobility revolution, if you can think about how many pacemakers could you fit in an EV battery pack, I mean, it's thousands of them. That gives you an idea of the scale that these materials need to come up to really be a viable solution.

And while that scale is feasible, it takes time. It's high capital intensity. That would be the third aspect of the technology that really made it, to use your words, a no-brainer, in that while there's optimization always with supply chains, it is not that big of a step function when you look at other alternatives in the space.

Todd Crescenzo:

Yeah. And maybe if I could just hop in there on the application of it, right? Because I think there's a lot more technical aspects to ION's secret sauce, if you will, and differentiating. But what does that enable from like a commercial, practical standpoint? And from an investor standpoint, how we thought of this as what I would call like a platform technology in both a horizontal and vertical respect?

And so the vertical respect is that because you can do a full-stack cell, right? That is an end-state for a product. And the form factor based on all the aspects that Jorge just outlined really gave us flexibility to move into different markets, whether that's consumer electronics, energy storage, at the distributed level, grid-scale, and/or EVs in different form factors. Literally, size and shape. But then, also, what is very, very unique is ION's ability to be cathode-agnostic, and that allows us to really be, as Jorge mentioned, designed in as part of the architecture of whatever the end-state product is.

And so as we think about the depth and breadth of these markets, they're quite large, right? And the innovative solution that ION provides, it's really quite compelling. And so I just wanted to kind of tie that to really the technical and material science differentiators. But where that allows us to, as a company, grow into is pretty exciting.

Bill Derasmo:

Well, it sounds like a wide breadth of potential applications. And so that's got to be exciting for you guys. Before we go to the market, there's one technical point I wanted to geek out on for a second. Because whenever I hear about ceramics, I think of temperature, and I think of the advantage in handling the heat problem. Because they use ceramics in space with respect to NASA and space exploration, because of its ability to withstand heat, right? I don't know if you want to just address that point quickly.

Jorge Diaz Schneider:

Absolutely. Yeah, you hit the nail on the head. I should have said four. You're right on, Bill. The operating temperature of the battery is also something that the technology allows to expand. This is now a battery that I'm sure everybody has seen the warning on your phone when you take it to the beach. I'm heating up. I'm going to shut down. Sorry. And you're basically left without your device. Similarly, if you're in very cold temperatures, your battery discharges almost immediately because of the limitations of lithium-ion. That range where the cell cycle happily is tremendously expanded by use of a ceramic electrolyte. You're spot on.

Bill Derasmo:

I love it. I love it. Let's talk a little bit more about this range of applications, right? Where's your sweet spot right now, and where do you see the evolution for ION moving?

Jorge Diaz Schneider:

Our sweet spot is we have recently become the only solid-state battery company that has successfully sampled working cells to the consumer electronic space. That is something that is unique to ION. Nobody else has been able to do it. The reason is very simple. Everybody else has had to re-engineer the cell to accommodate their technology.

If you need a cell that needs compression, you have these pictures online of springs, and boxes, and plates to compress the cell in order for the cell to work for a specific – let's say, a sulfidic electrolyte or a polymeric electrolyte, etc. The only application where that can work is an EV because you have a lot of space. You can basically use the space for all these gadgets to compress the cell. That's why, quite frankly, solid-state was out of reach for some of these consumer electronics applications.

And what ION has really – to your point, the sweet spot, has been we have recently launched a working scale cell, known as Cornerstone, and we have been able to sample it to basically significant number of consumer electronics companies. And what that is providing is both validation of the space. And it's been quite, I would say, interesting to have these conversations with these customers. Because the first thing they do is they call us and they said, "Yeah, did you forget the pressure plates? Because that wasn't in the box." And you basically go, "Well, no, there aren't any." "Really? For real? Do you just want me to plug them into my cycle?" "Yeah, just put them in the channel." Right?

And so it's been really, really powerful in a span of just three months to see this tremendous lift of interest in the space. More importantly, this is one validation, right? In parallel, we have been able to also prototype EVs. We're not divorced from EVs. But here's how we did it, because that's pretty powerful. EVs, rightfully so, have been looking for solid-state for a very long time. They've invested millions of dollars in their own cells and their own prototypes. And they've been very open, "Look, Jorge, love what you're doing, man. But I'm not going to go back and reinvent the wheel here."

We believe in the technology that we've been putting together. But guess what? The cell still swells. Would it be possible for us to sample your anode as a solution? Not your cell. Of course, for us, that's an immediate, "Absolutely." We're not here to reinvent the cell. We're here to enable all of those cells. And so, it's been very powerful again in the same three months to been able to supply two types of prototypes. Cornerstone, which is the technical solution in the form of a cell for consumer electronics purposes and in the form of an anode for EV and NUV validation.

John Leonti:

And so, Todd, from your perspective, how do these features position ION to compete with the traditional battery players?

Todd Crescenzo:

That's a great question, John. I think it gets back to my point earlier or comment earlier about enabling technology, right? And so the example Jorge just outlined hits the nail on the head, right? We can obviously do a full-stack cell, but being able to also provide an enabling technology in the form of an anode that empowers their existing cell and chemistry designs that they've built out and have spent a lot of money on is a less-friction path to move forward, right? At the end of the day, the adoption cycle in an EV is quite long from a qualification standpoint. If we just think about from R&D to production, it's incredibly long. The TAM is quite large, but it takes time and it's capital intensive.

The ION technology circumvents that or short circuits that. Because as Jorge just outlined, he can go directly to EV customers and start talking about how it's enabling them. And I think that's really the differentiator here is depending on what end market. We have bookends that we can bring to the market with a commercial solution that's really, really technically differentiated.

John Leonti:

And Jorge, you mentioned Cornerstone. Where does this achievement put ION sort of in the competitive battery market? What do you think's next?

Jorge Diaz Schneider:

The next stage is – what Cornerstone is achieving is it is making the technology real for the segments. It is validating our commercial roadmap, and it is generating a lot of interest. It is basically saying all the things that we don't believe the technology can do are proven with Cornerstone.

Here's dovetailing off of Todd's comment that I think is very important, right? If you look at other alternatives, because everybody's working around limitations, most solid-state batteries are going after it with a single-cell, single-cell prototype. And that's not the path that ION's technology needs to follow, right?

The next step, as we continue to gain success with these customer electronics, we have the flexibility to identify targeted adoption platforms within consumer electronics. Think about that, right? Rather than building a battery that meets the cost threshold for the EV space, which is where everybody's going, "Okay, make it cheap. Double the energy density. Make it safe," all those things, we don't have to go there. Consumer electronics allows a product diversification that is unmatched in the industry.

I mean, these are companies that make anything from a wearable device all the way to AI servers and massive computers and mainframes, right? The footprint of the battery, the world is

our oyster. Some of them was telling us that there's hundreds of cell prototypes that they do on a given year. That allows a massive opportunity to identify, first of all, high-value applications. Because, obviously, that is what you need when you're introducing a technology. Your starting point has to be a use case where the first barrier to entry is not cost. It's performance, right? That's really the first step.

And the second is the nimbleness of that. We're able to say, "Look, we're going to do a run of a million devices by 2028, and the cell that's needed has this footprint." You have a zeroed-in target. Oh, it's a battery pack for an EV. Well, what EV? Is it a luxury sedan? What is it? What is a horizon? There's so much that comes with having that targeted volume and application in the near term that really enables that next step in the development.

Long answer to your question, John. Cornerstone validates the technology and opens the door for the next iteration of batteries to not be something that we're going to offer to the mass market, to be something specific for a specific use in a high-value application.

Todd Crescenzo:

Maybe I could just build on that a little bit and maybe almost even take a step back and say what is driving the market to even consider solid-state, right? And there's a lot of macro factors and micro factors that are certainly a tailwind to solid-state. But then kind of further building off those macro and micro features, if we think about the analog to like the semiconductor space and the journey that an Intel, versus AMD, versus Nvidia have been on as the cycle changed over the last 50 years, I think it kind of easily is surmised as compute has to go up, right?

For batteries, as compute goes up, consumption of energy needs to go up, and/or it needs to be deployed flexibly and in a matter form fitted to the device, right? If we take our iPhone the reason, we shut this off at 30,000 ft is not for interference with Starlink. It is because it's a lithium-based battery, and there's a safety issue. That's one issue that we're solving at ION is there is no thermal runaway.

Moreover, as more compute is required out of this phone, there's only so much real estate. And so if your compute footprint is going up, then maybe your battery footprint could be a trade-off to go down. At the same time, they're consuming more power. You don't really want that, right? Again, you need a flexible form factor and you need an ability to have technologies that can fit into, to Jorge's earlier point, an array of end-state product fits.

As we think about like an Nvidia, where they started in GPUs for gaming, the end application really changed even though the core technology was always there, right? And so you have these really sort of Moore's law moments where there's step change, not incremental change. And it feels like, in the battery space, that's where we're at. A solution that is equivalent in ION is a very, very powerful combination to the macro and micro factors driving the secular demand. And then, also, just what are the differentiated aspects that allow that for us to execute at ION?

John Leonti:

I don't know that we can get through any news article, or podcast, or anything these days without mentioning AI. And you kind of alluded to it with the chips. Just from a – maybe not an application perspective. But how is AI impacting your business, whether it's from a technology perspective, just from a science perspective, research perspective? Just love to hear how you're either incorporating or using those tools in your business.

Jorge Diaz Schneider:

Terrific. Terrific question. The company hosts a quarterly breakfast right after our board meeting, which happens this week as well. Right on cue. One of the things that we highlighted today as one of the achievements of the team is the 26-layer cell was built in two weeks. Not two quarters, not two months, not two years, two weeks from the Cornerstone prototype.

The only way we can achieve that is we are passionate about what we do, but we're also passionate about data. And so there is a tremendous data science apparatus behind everything that we do. The Cornerstone prototypes, the standard deviation of their core performance is 1%. 1%. The way AI is core to the model is this kind of speeds and innovation can only be brought to life by being truly passionate about data gathering, data intelligence, data science overall.

The other aspect where we use that tremendously is in simulations. There's a lot of tools out there for simulating cell performance. And then lastly, in quality. A lot of the inspection, if you can imagine, is based on you need to take a look at our ceramic coming out, and it has to be pristine. And so a lot of the things are not visible to the naked eye. We partner with world-class companies that have been in the semiconductor industry and that use AI algorithms to analyze high-throughput quality checks of our product to make sure that, at the end of the day, we can guarantee that very narrow standard deviation as far as cell performance is concerned.

Todd Crescenzo:

The market pull from AI is that, obviously, I think as energy experts, we can all appreciate that compute requires more energy. And marginal energy production is hard, right? It's very easy with renewables. It's very hard with combined cycle, natural gas, nuclear, etc. There are long lead times. And so as AI continues to expand, because all of us are using it more and more often there's more energy demand.

And so, again, back to ION being architected into devices. If more of the energy is consumed at the device level, I think that is almost like the distributed behind the meter analog, right? If there's more power that can be sourced at the device, it allows for more flexibility upstream at the grid. And so, it's a real strong value proposition in terms of everything that AI is pulling forward around energy consumption. And whether that's at the data center level, the ISO level, it's obviously all related.

Bill Derasmo:

Todd, I was wondering if I could just shift gears from the investor perspective. How do you separate out the noise, so to speak, from truly valuable, investable, bankable technologies? On this podcast, in the past, we've talked about a variety of different approaches, battery chemistries, technologies, everything from vanadium to different forms of lithium-ion, zinc, other approaches. And obviously, you're happy with ION. If you could just walk through how do you sort through all of that when you have an opportunity?

Todd Crescenzo:

I think, most of the time in investing, it depends, right? What is the end market? What is the valuation? What is the technical merits? And so you obviously try to do a lot of that technical work on the front-end in terms of diligence. But it starts with like what are your core thematics that you're trying to express a view around? And one of the things that's really important to us at Clear Creek is we don't invest in competing technologies, right? We run a very concentrated portfolio. We enterprise build with our management teams, right? And we want to be a value ad partner. And so we do a lot of front-end work to get comfortable with, I think, to your question, sort of the technical merits.

And one of the funny things in batteries is I feel like the word chemistry and technology get interchanged. Like, "Oh, this technology versus this chemistry." And the reality is, is it's kind of like coal, natural gas, or nuclear. They're all a solution depending on marginal costs of production. Again, what are you trying to achieve? We never thought of coal as solving a capacity issue in PJM because it's too expensive to kick up. It's a base load solution, right? And we need base load because then you could add incremental load that is part of a capacity price market, and you could use combined natural gas cycles.

I think at the end of the day, there's a lot of different solutions in battery chemistries based on end market application. And then sort of for us, as we've built out our portfolio in sort of broad strokes, what we'll call energy transition, we've really been thoughtful about those end markets and what the needs are. And can the technology provide a solution?

For us, ION is really the deep innovation technology that has a lot of solutions to a lot of end markets, but it was a little earlier stage, right? So we need to be patient and work with the team and grow the technology to where we think and know it can go. On the other hand, we have a portfolio company that is in market, it's a very unique technology, but it is very much solutions-oriented for grid-scale storage next to the data center. And then we have a portfolio company that is really the pulsing energy technology for when the grid may go down and that backup battery system that can store for 8 to 12 hours comes on, right? And that's a very different part of the value chain. And so there is no one silver bullet. Not to skirt the question. I think it just really depends on those end-market application needs.

Bill Derasmo:

Yeah, I think the wholesale markets are at a really fascinating point in time right now. And so I would ask you, while we're on this topic, where do you see long-duration storage going versus a typical maybe 2 to 4-hour application for a grid-scale battery?

Todd Crescenzo:

I mean, John's probably the real expert to answer on that, but I'll give a reasonably informed view, which is I think we are moving to a similar analog as to what we have in the current, let's just say, energy portfolio on generation, right? It's a mix of coal, it's a mix of nuke, it's a mix of wind, it's a mix of solar, it's a mix of natural gas, mix of oil, mix of steam, etc.

And so as we think about how then, in batteries, each of those break down into whether it's 2 to 4 hours, 1 to 55 seconds, or 8 to 12 hours, right? Those are all going to be parts of a stack, right? And I don't know they'll be deployed like in an ISO case, where you're going to have day-ahead markets. But, certainly, we'll shift the duck curve, right? And that will have an impact on price. And so maybe it's like if we think about the on-peak hours versus off-peak hours pricing, you might see shifts in that. You might not have as much capacity pricing in a PGM marketplace because some of that pressure has been taken off through the different form factors of batteries that are integrated into the broader system.

Bill Derasmo:

Yeah, I think just really quickly on that, the regional markets are grappling with that issue. And some of the things I've seen are different regions are playing around with are there other ramping products or energy market products that might be able to take some of the heat off of the capacity market because the capacity market issues have become so difficult, so controversial? Yeah.

Todd Crescenzo:

I think we're in the early days on that, right? I think there is going to be very innovative market-based solutions to solve for that. I mean, this is kind of pie in the sky. But to your point on the regional ISOs, it's like Texas has a very different need than PGM, and California has a very different resource base relative to, say, MISO. And so could you produce electrons in California, store them in a battery, drive them to MISO, plug it in, and then arbitrage off and on-peak prices? I mean, again, I'm being extreme for the purpose of like, yeah, you're basically just armed out transmission. But that is really the key, right? There's a lot of things that are going to play out in energy transition that are still forthcoming. And I have no doubt that investors in Wall Street and energy traders will come up with very creative solutions around that exact point, Bill.

John Leonti:

I do think that long-duration storage has a role to play, I think, both in the ISO markets and in the regulated markets. It's just a different use case. But there's clearly a need for that. Because in both those markets, look, you have resources that are there. And particularly with some of the firm requirements of the data centers and others, it's just there seems to be an opportunity for all of that, so long as those folks can bring it to scale.

Bill Derasmo:

Really appreciate you guys being on the program today. It's been an interesting discussion. I think we got a lot on ION, we got some on Clear Creek, we got some on the energy markets. Really appreciate you guys being on the program. Why don't I give you each the last word here? But I will just say thanks again.

Todd Crescenzo:

Thanks for having us. We really appreciate everything Troutman Pepper Locke does for us as a firm. And so from the bottom of my heart, just thank you very much.

Jorge Diaz Schneider:

Thank you, Bill. Thank you, John. Delighted to have taken part in this conversation. The first of many to come. I'll wrap up with this. One of the things that is often taken for granted is the support of the investor community for the vision, the purpose, and the execution of that vision. And so one of the things that makes this partnership with Todd and our other investors that have been with ION since the beginning is a relationship based on genuine trust and the camaraderie that comes with taking on tough challenges for solving things that we all feel very passionate about. That is one thing that I would leave you with, that, again, it is something that I certainly do not take for granted, and that I'm absolutely convinced is one of the elements for success of what we are in the process of achieving. Thank you.

Todd Crescenzo:

Well said. And maybe just one last thing around that is what motivates us all is, I think, probably thinking forward and doing better for the next series of generations, right? And ION, to me, represents that technology that can really have impact in energy freedom. It's a US-based developed technology. It's great that ION was never a customer of Jorge when he was at Albemarle, right? Because it's the lithium-free aspect. It is what drives innovation that is so central to ION. But, really, that energy freedom for the US in terms of energy security and broader policy implications, but also, really, innovation.

Bill Derasmo:

Well, excellent. On that theme of trust, we appreciate that you trust and partner with us and our firm, Clear Creek. Appreciate that very much. And John, why don't you go? And you really, truly will get the last word.

John Leonti:

This is a great conversation. Appreciate that we were able to get this on the books. It took us a minute to have this conversation, but I'm glad we did. And thanks again. And I appreciate your time.