Battery + *Storage* — Vanadium Has Entered the Chat

Host: Bill Derasmo
Guest: Shane McBee
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Bill Derasmo (00:03):

Hello and welcome back to the Troutman Pepper Locke *Battery and Storage* podcast. I am your host, Bill Derasmo, partner at Troutman Pepper Locke. Today I am very pleased to have with me Shane McBee. Shane is the Vice President of Business Development at Invinity Energy Systems. Welcome to the program, Shane.

Hey, Bill, thank you for having me. I'm excited to be here today.

Bill Derasmo (00:27):

Excellent. Well, Shane, why don't I give you an opportunity to introduce yourself and your company Invinity and some of the exciting things that your company is doing?

Shane McBee (00:38):

Absolutely. Thank you. Invinity is the disruptive innovator of non-lithium energy storage for our carbon neutral grid that we're all pushing to achieve by 2030 and beyond. We're a venadium flow battery, a different chemistry. Of course, lithium being the incumbent that's been around for 20 and 30 years. Right now, we are headquartered in Motherwell, Scotland and Bathgate, where our two main facilities are. We also have a facility in Vancouver, British Columbia, Canada, and we have domestic stateside supply coming a quarter of this year. So as we grow our footprint, also the same as the domestic footprint, we'll have manufacturing in India as well. So right now, one of our things that we're most proud of is we've gone over 2000 battery modules globally delivered and we surpassed last week nine gigawatt hours of dispatched cycled throughput. All of that with a 96.3% availability, which really shows the robustness of our chemistry and not only the communities as well as the off-takers and utilities enjoy having an option to choose a non-lithium technology that does not degrade and has no possibility of thermal runway.

Shane McBee (02:06):

So several benefits to kind of go over today, but that's the gist of who Invinity is. A culmination of Avalon battery and a merger with red tea, both about 50 years of experience combined and became Invinity in 2020. We are the global leader in proven vanadium flow battery technology.

Bill Derasmo (02:27):

Excellent. Well, thank you for that. As you know, we've had Venadium flow batteries as a topic on some previous episodes. So we've got multiple people playing in the space, but I think you guys have a real good story to tell, real positive story to tell. So why don't we start out with the advantages of venadium versus lithium ion. I think you quickly hit a couple of them there, but let's remind the audience of some of the fundamental differences if you use a vanadium flow battery chemistry.

Shane McBee (02:58):

Yeah, absolutely. I think the way we like to think of venadium, not only is its availability in the earth's crust, this is a very robust metal on the periodic chart of the elements. The thing that makes venadium so resilient is that it can exist inside the electrolyte in four different states of oxidation. So by keeping the technology itself, you've got pumps, pipes and tanks, and then you've got a cell stack that sits on top. That's about 60% of your bill of materials. The other 40% is the veladium electrolyte. The vedium allows the electrolyte to exist in four different states of oxidation and never have calendar or cycle degradation. So truly, but ADM flow batteries are the workhorse of the non-lithium batteries on the markets. They can cycle multiple cycles a day, giving them the ability to operate without thermal runway and zero need for HVAC to keep them cool through the duration of the life of the battery.

Shane McBee (04:05):

So vadium a lot different than lithium. Lithium's got its place. It's real good in those real tight durations and discharge durations. Venadium's more your long duration storage that dispatches and discharges from four to 20 hours. Venadium really, really sets the ... As a technology, the flow battery is about 150 years old. Then you add the chemistry of anadium and it's a 50-year-old technology. So much more proven than a lot of incumbents or other non-lithium technologies that are in the market. We've got dispatchable proven assets that are already out in the field and out ahead of the curve a litle bit in that aspect.

Bill Derasmo (04:46):

Well, let's talk about a couple of things that you said there. For the layman, why is venadium superior to say lithium ion if you want a long duration solution? And so when we talk about a two-hour battery, that's obviously a shorter duration. Four-hour is a lot of what ends up being installed in the market right now, but that's still on the shorter end. But I think as procurers of storage solutions become more sophisticated and really look at what they need, long duration is going to be put into RFPs and that sort of thing, I think, with more prevalence. So maybe you could talk about why Vanadium's superior solution for long duration.

Shane McBee (05:26):

You touch on a good point, Bill. We like to say that the gap between ambition and execution is what defines the opportunity. And when we look at it that way, it's these procurement teams, they come up on an opportunity and they say, sometimes it might be the best fit for the use case

to say, "What's the cheapest battery I can make economic sense on day one?" And on a banadian flow battery, you're going to see a 30, 35% premium over lithium, but we'd like to take that opportunity to really get in there as a consultative extension of our developer, of the utility, of the off taker and really show them and learn with them in lockstep over time what that looks like in terms of an asset that's a 30-year non-degrading annuity versus just a disposable asset that might need to be augmented at year eight and again at year 13.

Shane McBee (06:22):

Oftentimes those savings that you feel you're going to save with that 30 to 35% premium on day one, they get eaten up and retooling the cathode, which you don't have to do in a vanadium flow battery. So there is no augmentation, very resilient element inside the electrolyte because of the resiliency and the ability of vanadium to exist in those four different oxidative states without having any kind of ... We can simply adjust the, this is kind of the chemistry geek. I mean, I'm a chemical engineer by degree, but we can adjust the valence of the V2, V3, V4, and V5 as they're existing outside of. And by keeping the cell stack separated from the actual electrolyte tank, it gives us the ability to have a battery that is not only resilient, but non-degrading with no cycle throughput degradation and no calendar degradation. So this battery can run multiple times a day allowing the off-taker to participate in a multitude of use cases from grid resilience to arbitrage, merchant market service participation as well as front of the meter, behind the meter, CNI grade applications, the data centers that we all are talking about that are coming online have intermittent generational smoothing requirements that Vanadian flow battery's very good at and I'm sure we'll touch on flex base here in a second, but that ability to do solar smoothing and peak shifting in the afternoon if they want to multicycle and kind of smooth out some cloud chop from PV generation on renewables in the morning as well as microgrid.

Shane McBee (07:54):

So while it might not be as dense as lithium and you might have a 30 to 35% premium on day one, the life cycle cost, the levelized cost over the life cycle we like to call that alcos is really where that procurement team really likes to learn how it works and what their economic erosion is over time of an incumbent system that you may have to go in and retool the cathodes, reaugment over time. We don't have that with the vanadium flow battery. You've got a resilient battery that does not degrade and can last 30, 30 plus years with no thermal runway and then recycle at the end of life and have residual value in the reclamation of the vanadium as well.

Bill Derasmo (08:38):

You stole my thunder because I was going to try to sound smart by asking you about the leveliz cost of storage because I think that's the concept that you're getting at, right? If you compare the life of the asset, the capital cost over the 30 year life, for instance, and you're getting into more of a concept of the leveliz cost of storage and it sounds like that your vanadium product is going to have a lower levelized cost of storage and you ran through a number of use cases for it. So when you were talking about things like solar smoothing, dealing with the intermittency of renewables, being able to cycle it multiple times over a short period of time, it starts to be more like a quick start generator or a generator that can provide load following those types of flexible uses. Maybe you could just talk about that if you are, again, if somebody's in the market to

procure something that they need, maybe just speak about the flexibility of your battery and then also the fact that it competes well when you look at the levelized cost of storage.

Shane McBee (09:47):

Great way of queuing that up. There's a structural tension that's created when we shift from dollars per kilowatt hour to actual life cycle value costs with an operationally proven technology. I think you're leaving a lot on the table some of these procurement regimes when we just think about dollars per kilowatt hour. We're not going to have the density of lithium from that. We also do not have any rare earths or conflict materials like cobalt and some of those things when you get to the end of life and you have to recycle those items as well as the way vanadium might be mined and pulled and processed to go into the electrolyte versus lithium, all of those things weigh in. But it's important to think if you can multicycle a battery and participate in additional revenue streams in the afternoon, a lithium counterpart can do that as well, but what happens is you take a 20 year asset and make it into a 10 because every cycle then degrades your warranty and the life cycle of the battery or how much quicker you're going to get to retooling the augmentation of the cathode and not having that certainly has to extrapolate out over time.

Shane McBee (10:54):

Here's what you're going to save by not having to run HVAC for 30 years. Here's what you're going to say by not having to worry about fire suppression because we have no thermal runway. The operating and maintenance part of it is what, Bill, I think you're pointing to these procurement folks really like to be able to say, we want to be able to have a workhorse of a battery come in, help us participate, show us how we can stack revenue streams, meet the PPA requirements for capacity credits that we get for our off taker and not have to worry about too much the maintaining cost of the battery. And that's really where vanadium flow shines the most.

Bill Derasmo (11:33):

You talked about the cycling issue and I think the early adopters, say for instance in PJM with lithium ion batteries, those batteries were being cycled in a way that wasn't optimal, put it that way. And so you saw the degradation of the actual cells and the life of the batteries were diminished. So it's a real issue and I think we've already seen it pretty clearly, but it sounds like you've got a better mousetrap in that regard. So that was good that you talked through that. I was going to switch gears though and talk about a specific use case and why don't you tell me a little bit about the flex base. I'll run through it and then you could explain what it all means, but the flex base 800 megawatt by two hour configuration that we talked about before we started the recording

Shane McBee (12:20):

Yeah, this announcement just came out last week. We're very proud of the two years that the team has put in to get named in this award to move into the engineering phase. This is going to be, let's step back. So Laufenberg is the juncture between the apex right at Germany, France and Switzerland. So there's a very large substation there that came to fruition in 1958 and this was going to be the European power grids kind of crossroads. And this battery now is going to

design part of it is your, you have a tank farm not really in the basement but going subterranean 25 meters. So you've got a 75 foot sarcophagus. The electrolyte tanks will be below grade and then you'll have your tanks, your pumps and your pipes above that and then all the PCS equipment and inverters above that. And what basically looks like a Class A office building sitting above the ground.

Shane McBee (13:19):

And it's Invinity's been selected by Flexbase to design the actual one and a half gigawatt hour vanadium flow solution for this technology center in Laufenberg. We did a press release on this announcement last week. The battery is going to support an AI data center technology campus as well as providing support to the European grid network. We were selected following a very in-depth process, which the assessment of all major non-lithium battery manufacturers globally to move into the engineering phase. This will last through the end of this year and into 27 and then the fulfillment phase to commence from 27 onward. It's at one and a half gigawatt hours with the stretch to 2.1 as an expansion engineering phase completion will be done in 27. So we're very pleased with it. This will be the largest Venadium flow battery in the world.

Bill Derasmo (14:12):

That is amazing. The largest Vanadium flow battery in the world. Congratulations. And so what about taking that model here to the United States? Tell me about your activities on the ground here in the US and what Invinity's plans are for this market.

Shane McBee (14:29):

The thing that makes the flex space design so neat is when we talk about long duration storage. This is actually a two hour battery and it shows the innovative powerhouse that is the superlative engineering mines at Invinity. Right now we have the largest vanadium flow battery in Canada, Australia, the UK and the US through complexity reduction has allowed us and our customers to operate these systems to specification through different pillars of excellence that we internally as a company and through our senior leadership have gotten real good at. So we've become a consultative extension of our developers and off takers to have a pretty good footprint coming into America already. We've got some California Energy Commission projects as well as Department of Energy pilots that are up and running. The VAHAS project that's in California is the largest vanadium flow battery in North America. And with domestic supply coming in fourth quarter of this year, we're ready to participate alongside all of our other non-lithium brothers that we want to get out and see be wildly successful as well as lithium too.

Shane McBee (15:39):

So I just think it's really good for us to get the market up to speed on vanadium flow battery being an additional arrow in their quiver. Lithium's been around a long time, certainly very good at what they do and constantly improving. We just want to be a non-lithium source that's provided when say a community decides for whatever reason they might not want to have lithium or they want to have a proven technology that doesn't stand the chance of having any kind of thermal event in their local community. We want our developers to consider us as a part of that pack.

Bill Derasmo (16:10):

Makes sense. And it's a fantastic story to tell. You have the largest vanadium flow battery in all these different countries. Well, what about your partnership with ABB and Gamisa with the Endurium model?

Shane McBee (16:23):

Yeah, the Endurium is our current generation. We did a launch on it in December of 24 and ABB Gamesa was a joint venture co-development partner of ours for Endurium. The thing that makes Endurium unique in its ability to be out in the market is a lot of times you deal with a lot of weight when you have electrolytes with a certain specific gravity inability to stack Endurium can stack when it gets out in the field. And we've got a union with a partnership with ABB that we can offer their PCS equipment through their inverters when we go out into the field with Endurium. But the thing that makes it neat when you single stack it, you can go take one acre and get 43 megawatt hours. If you do a double stack 86 up to 106 megawatt hours to an acre if you triple stack it, which is a pretty neat part of the design and the structural integrity of the actual container itself.

Shane McBee (17:24):

But all of that joint venture co-development partnership was done through ABB Gamesa, and we're excited about that union going forward so that we can offer both DC and AC integrated solutions to our customers.

Bill Derasmo (17:38):

That sounds fantastic. It sounds like you've got a lot of irons in the fire, a lot of things moving forward. Well, tell them about yourself. Obviously you're on the ground here in the United States. So how did you come to Invinity? And if companies are interested in doing business here in the United States, what do you want them to do? How do they work with you? How do they get in touch with you?

Shane McBee (18:00):

I'm a chemical engineer by degree. So I've got the chemistry geek side of me that loves touching things. I've been in the energy hedging and arbitrage space with a Fortune 100 company prior to entering into renewables for probably 12 years and then in the renewable space for the past seven. So non-lithium batteries is something that has really piqued my interest to be a part of what changes our grid. It's a big grid. There's a lot of work to do and there's a lot of players that are going to participate in that. So www.inviity.com and you can find me on LinkedIn, reach out there as well and we would love to be a part of your project. We kind of look at it as a partnership. We're selling more of a journey that we're going to walk side by side with you to get to a finish line and we're not going to bow out of your project until we have site and visibility to completion as well.

Shane McBee (18:53):

Another project that really I enjoyed being a part of early on with my time that started here with Invinity is the largest European flow battery is called Copwood and it's in East Sussex. We just got it delivered. It's 21 megawatt hours. We're excited to see site and visibility to get it up and online next quarter and that'll be the largest flow battery in the UK as well. So www.invinity.com is how you find us.

Bill Derasmo (19:23):

Sounds fantastic. You're being modest, by the way, because you also have your MBA, so not just an engineering background.

Shane McBee (19:30):

I did. Yeah. And one of the things was funny at the time, Bill, when I got that, I had one daughter at the University of Florida. I lived in Palm Beach down there at the time. I had one daughter at the University of Florida, another one at Florida State, and I was getting my MBA at the University of Miami. So we didn't know football season if we were seminals, gators, or hurricanes half the time, but we knew we had all the educational facilities covered.

Bill Derasmo (19:51):

I love it. I love it. Well, Miami had a good run last year. They just ran into a buzz saw with Indiana.

Shane McBee (19:56):

They sure did. Well,

Bill Derasmo (19:57):

We'll see how it goes this year. I think the ACC will be interesting. I went to law school at Wake Forest, so I think Wake Forest plays Miami this year.

Shane McBee (20:05):

I think so.

Bill Derasmo (20:05):

That will be a good game. We'll have to keep an eye on that.

Shane McBee (20:08):

It's all about the U, so be careful.

Bill Derasmo (20:12):

Well, I've got tickets to the Wake Forest Virginia game, so that one's closer to home here. I'll be looking forward to that around Halloween. But in any event, as far as the business is concerned, I mean, I think what I would say to the listeners out there, for the people who are involved at the state level PSC or things like NYCERTA, state procurement offices, think about the value of long duration storage. Lithium-ion two-hour battery, four-hour battery is great, but think about what your goals are. You're trying to do purement efforts. Long duration will be a really important tool going forward. For the utility market out there, for the utilities where you might have retiring generation, consider long duration storage as a possible substitute. There are challenges with citing large generators. I know it's happening in certain parts of the country, but long duration storage could be something that you would consider if you're going out for an RFP for new resources.

Bill Derasmo (21:14):

So just wanted to add that in there because I think as you said, we get caught up with the cost per kilowatt or cost per kilowatt hour and you have to look at what exactly it is that you're buying because a long duration storage solution, especially when we're coming into an era where we've seen over recent years, we've had these challenging events where it's a cold snap for three or four days that's extreme. We had it even this past winter and I know I live through it here in the Mid-Atlantic and that's what really challenges the grid are these long events that happen over the course of a couple of days where if you had added a two-hour battery, four-hour battery, that's fine. It'll help for that period of time. But the grid and talk to the grid operators like PJM or MISO, they'll tell you the real challenges come when it's that multi-day event.

Bill Derasmo (22:06):

So in any event, that's my plug for long duration storage. And I think truly from a societal perspective, I think it truly has an important place as we move forward here that it's a solution that is going to need to be part of the package of solutions.

Shane McBee (22:22):

Bill, I'll tell you one story to share is I've got a colleague that owns a welding fab shop in Halsted, Kansas. They're in the Southwest power pool, that's their ISO. And he had received a curtailment notice where the fab shop isn't going to be able to weld or make trailers or cage ladders, whatever his thing is he's doing that day. On Tuesdays and Thursdays for the next 60 days, they're not going to have the electricity that they need for their welding from say 1:00 to 6:00 PM. And that's a true indicator of curtailment. And then when he made the call to the mayor and the mayor and I got on the phone together and we thought, wow, this is really a true story of you can't just shut the fab shop down for five and six hours every Tuesday and Thursday for the next 60 days.

Shane McBee (23:09):

What would be a good solution for that? And we immediately thought if you had a renewable asset, even if it were PV panels on the roof of the fab shop and you stored that solar power in a battery, the fab shop could run on the battery during that curtailment. So there's a lot of pieces of it. Then you've got states like California where there's so much PV generation, sometimes they'll have to dump two or three terawatts back onto the grid because they didn't have an off taker and that's a place where you think batteries would've really solved all that for California Energy Commission not to have all that surplus and yet no off taker to deploy it. So batteries have a key part of moving our renewable efforts into the future and we are confident the vanadium flow batteries are going to be a very substantial part of that.

Bill Derasmo (23:57):

Well, thank you for sharing that real world exam. It's important for people to understand. I think we've talked through a lot of important issues. I think we've given the audience a clear picture here of why vanadium flow and long duration batteries are an important part of the picture. And so I hope the audience will consider giving you a call or looking you up on invinity.com and potentially partnering on a project.

Shane McBee (24:23):

Very good. Thank you, Bill. I've enjoyed our time.

Bill Derasmo (24:25):

I have enjoyed the conversation, Shane. Thank you so much.
