

BATTERY + STORAGE S03 EP 18**ELECTRO-EXTRACTION AND THE FUTURE OF E-WASTE WITH MEGAN O'CONNOR, CEO AND CO-FOUNDER OF NTH CYCLE****RECORDED: AUGUST 10, 2022****Bill Derasmo (00:03):**

Welcome back to the Troutman Pepper Battery + Storage Podcast. I am your host Bill Derasmo, and today our guest is Megan O'Connor, the CEO and co-founder of Nth Cycle. Welcome to the program, Megan.

Megan O'Connor (00:16):

Thank you so much for having me on today.

Bill Derasmo (00:18):

Yeah, absolutely. Thanks for being on the program. I want to talk to you about your company, Nth Cycle, but before we turn to that, I wanted to just give you a brief introduction to the audience. You have your undergrad degree from Union College and your PhD from Duke, where one of your co-founders at Nth Cycle was also your advisor, Dr. Desiree Plata. So tell me how you went from the academic world to starting your own company. And I understand there's a number of steps that I breezed over in between probably, but I figured with that prompt, I would just let you start talking.

Megan O'Connor (00:54):

Yeah, I think it was an interesting journey that we all made to get to this point, but we're excited. It's actually our fifth anniversary this month, so we're very excited, but the technology itself, the core of Nth Cycle was actually invented by our third co-founder, Chad Vecitis, who was a professor at Harvard back in the 2008-2009 timeframe. So this core technology's been around actually quite a while, and it was invented for a completely different application in wastewater treatment. And I came around in the 2014 timeframe and met Chad and was like, "Wow, this is a really interesting piece of technology." I didn't really think anything of it at the time, and then couple months later, I started digging into circular economy and all things around critical minerals and was astounded how little there was in terms of chatter about the fact that we don't have enough of these critical minerals to really transition over away from fossil as fast as we need to or want to.

So the third thing that happened around this period, which I think it was all luck, if I'm being honest, was I found my way into this Green Electronic Summit, they called it, where one professor had invited lots of folks from industry, Dell, Apple, the major consumer electronics brands that we all know and think about, to the university, to talk about the sustainability issues they saw coming down the line over the next five to 10 years. And I somehow negotiated my way into this meeting, even though it was completely close to students, and just was a fly on the wall. And over and over again, I heard them all say that they were very worried about the supply chain issues, so where they were going to get all this cobalt, where they're going to get all this nickel, as electric vehicles started to ramp up, especially in the 2025-2030 range.

Paired with that was what were they going to do with all of these iPhones and different consumer electronics and different e-waste coming out of consumers' hands and off the roads once it reaches

their end of life? And they didn't really have a great waste management solution. They all wanted to recycle. I think at the core of who they are, they want that, especially brands like Apple, they want to be at the forefront of this movement, but if it doesn't meet their bottom line and they can't make money off of it, they're not going to do it ultimately.

So, that was the two big problems I heard and this aha moment of, "Wait, if we use this really cool technology that I saw from Chad for this application, I wonder if we could help solve this issue?" And so, that again was in 2014, and I was smack in the middle of my PhD years, decided to completely change my project to work on this, which is probably the first crazy decision I made. But we got it to work three years later, and then we were like, "Oh crap. It works. Now, what do we do?" So it's all these good problems to have, we sat down at actually a bar in Boston near Harvard Square, and decided "Let's do this, let's try to commercialize this and build the team that can help us really bring this out into the world." And so, in five years later, here we are.

Bill Derasmo (03:34):

That's a fantastic story. That's like the all American garage-entrepreneur type of story. It's very inspiring, actually. I like hearing about that. So let's fast forward to Nth Cycle. There's been quite a bit of discussion over prior podcast episodes on this program, but out there in the media, in general, talking about second life options for batteries and battery materials, and there's basically, you could take second life applications like taking car batteries and then using them in stationary storage for grid scale applications, or you could recycle the material. Start with walking me through where Nth Cycle fits into this picture.

Megan O'Connor (04:13):

We work in a couple different places across the supply chain, both at the very beginning. So we work with mining and refining companies to actually help them mine this material out of the ground in a much more sustainable fashion, and then we also work at the very end. So with recycled goods, like you said, with EVs coming off the road, wind turbines coming out when they reach their end of life, and when they're finally done, so I think second use definitely has a place, but we come in when you can no longer get any life out of this material anymore, and we reprocess it back into the minerals that can go right back into the manufacturing supply chain.

Bill Derasmo (04:45):

And with Nth Cycle, this gets into, you were saying, how one of your colleagues had built a better mouse trap. How do you differentiate Nth Cycle from others that might be out there?

Megan O'Connor (04:57):

The traditional way that you refine, I use the word refine, because recycling and mining actually use the same chemical processing to pull these materials out, which I don't think a lot of people realize, which fascinated me the first time I heard that. So the way we refine materials, whether it comes out of a battery or it comes out of the ground, is typically done in two ways. You can either do pyrometallurgy, which is just a really long word for you burn it in a furnace, so really high temperatures and pressures. They do this a lot in Asia. We have a couple of these in Northern Canada. Or you can do the hydrometallurgy route, which again very long word for just saying you basically dissolve everything in acid and then use lots of different chemicals and solvents to pull these materials out one by one.

Both of these, as you can probably tell, are very expensive to set up, so we didn't invest in any of this infrastructure here in the States from a cost perspective and from an environmental perspective. They just don't meet a lot of the state's requirements. And they're usually only built out for one specific type of material. So it's very, I wouldn't say niche, because they're using a lot of the different applications, but one facility can be built out for one type of ore, or maybe one type of battery. What Nth Cycles technology does is takes the same feedstocks, but instead of building out a unit to just do batteries or to just do one type of ore, that one unit can take any type of material that has cobalt, nickel or earth metals, and process it all into a valuable output. And we do it all with just electricity. So instead of using the large furnaces or the high temperatures and pressures or all the solvents and acids, we put in a low amount of electricity and can pull out the same outputs.

Bill Derasmo (06:27):

Fascinating. So you use electricity. So, how does that work? How do you input the electricity just from retail service provider, that kind of thing?

Megan O'Connor (06:36):

We do, right now. Yes. We're hoping to switch over to all clean energy eventually. The way it works, I like to think of it at a very high level, like a Brita water filter that you have in your home fridge. And they have that carbon filter in there, that cartridge. The way that works, you pour their water through and it non-selectively pulls out every metal that could possibly be in there, no matter what the concentration is. We're doing something very similarly where we have a water filtration unit with carbon, but we figured out a way to push electricity across that carbon filter to selectively remove one metal over another. And in our system, we have these carbon filters stacked in series where there's a different electrical, current pushed across each. So you can imagine we pull out one metal on the first stage, then another metal on the second, and so on, and so forth. So we can selectively pull out these materials and leave behind what we don't want, so all the contaminants that tend to come along with the different waste and ores that we process.

Bill Derasmo (07:26):

So give me an example, if you've gotten a battery that might contain cobalt, lithium, manganese, whatever it is, how would you set that up in your system?

Megan O'Connor (07:37):

Typically when a battery comes off the road, it ends up at one of the collection facilities. So, Nth Cycles not in the logistics, we actually partner with folks who collect these and shred them down. And once these batteries are shredded, it's called black mass, which is a very generic term where they basically have the anodes, there's a lot of graphite and carbon in there. And then you have the cathode, which is all the good stuff that we're looking for, the cobalt, the nickel, the manganese, there's some lithium in there. So we take that black mass, we do a water-based digestion. So we basically turn it from a solid into a liquid, and then we'll go into our electrochemical filter. So very similar to that Brita filter I just explained, one stage will be set up to collect the cobalt and nickel. And then the manganese is separated out, as well as the lithium. So it goes through simply one stage of filtration, and we can pull out those four different products we pull out, but we can get the graphite, cobalt, nickel, the manganese, and then we produce a lithium brine.

Bill Derasmo (08:27):

Very interesting. I never thought that Brita water filters would be relevant to this program, but they are apparently.

Megan O'Connor (08:33):

That's right. Technology.

Bill Derasmo (08:36):

Who do you see Nth Cycle mainly working within the future, and just getting at who is your customer base, and also is that evolving as the technology moves forward?

Megan O'Connor (08:47):

Absolutely. There's really three verticals that we play in. The first is the scrap space. So as I mentioned, Nth Cycle technology is very unique in that we have a very large funnel, I call it. We can take in any type of feedstock that contains these materials and process them into the high valuable metals that we know and we use in manufacturing. So we work with any type of, they call it non-ferrous scrap. So we work with lithium ion battery recyclers, is one very small segment we work with. And then we also work with folks that have catalytic converters, any type of e-waste, catalysts from oil refining, really anything we can get our hands on that has that really great metal content in it that is typically mixed and just goes into a landfill or overseas to be refined. We try to do that here with the folks that we work with. So that's really the first group of customers that we're working with and scaling the business in North America with.

The second is refineries. And that tags along with mining, right? Typically, the miners that own the assets also have their own refinery, the vast majority of the time. In the refining space, there's a couple different places that we work in. One is in the actual refining these materials, so when they take the dirt out of the ground that has these metals and they're processing it into the metals that we know what they look like, they typically lose 40% to 50% of that really valuable metal. They call them bleed stream. So you can think of it just as waste material, even though it's really high value. We can go in with those folks and help them capture that lost material so that they can simply recycle it back into their own refinery.

And then in the mining space, actually processing their primary ore. So there's a lot of mines, especially here in North America that they're considered a short life mine, so they're not going to operate for decades and decades. So it doesn't make sense economically to invest in these traditional technologies that cost 500 million to a billion setup. They would just never make that money back. So with our technology, orders of magnitude less, in terms of CapEx, we can go in, process this ore, make our returns with under 10 years easily. So we can actually start to process more natural resources that we have here with a much lower carbon footprint. So we're not going to produce all the waste that you typically think of with mining.

Bill Derasmo (10:46):

Let me shift gears for a second and just go a little bit out of the business space for Nth Cycle, from a societal perspective, do you see room for both direct reuse and recycling?

Megan O'Connor (10:58):

I do. I think there's definitely more research and things that need to be done before. I think society, in general, are these companies that are going to reuse the batteries, are going to want to adapt them or adopt them into their systems. But I do think we'll see that eventually. I wouldn't be surprised if that happens over the next couple of years where we start to see packs coming out of EVs that will go into a second use. Because when they're done in EV, they still have a lot of life left in them. And so, it doesn't necessarily make sense to come right to us. But eventually, once this battery is fully wiped out, it will have to be recycled at that point. So we do think that there's a room for both, and we're excited to see that. We don't think it's a one solution fits all. I think there's many ways that we can get this circular economy to fully function.

Bill Derasmo (11:37):

One of your Duke fellow alums, Freeman Hall, he's been on the program. He would say, "Hey, we're already doing it."

Megan O'Connor (11:43):

Okay. So I'll have to go find him and talk to him.

Bill Derasmo (11:46):

I was one of the connections. I thought, I'm like, "Hey, Duke must be doing something right here because now, this is the second guest that we've had on in this space." And it's tough for me because I went to Wake Forest for law school, so I got the ACC rivalry going here.

Megan O'Connor (11:57):

That's right.

Bill Derasmo (12:00):

In terms of public policy now, we've got the Inflation Reduction Act, which it's a little bit weird, right? Because when you record a podcast episode, then it goes out to the public, so this will be heard in the future at some point, but it hasn't technically passed and become a law yet as we record. But everyone I think expects that it will in substantially the same shape that it's in today. I guess just jumping into that, I know me as an attorney here in DC, we're trying to figure out exactly what's in it, and I'm sure you've probably heard a lot about it. You're trying to do the same thing, but it does seem like there are some important provisions for your company in terms of incentives and provisions that relate to domestic supply content, domestic supply chains. I don't know if you've had a chance to look at that or if you want to comment on that, but it seems like it's a pretty important policy change at the federal level.

Megan O'Connor (12:52):

Absolutely. We are all at the company, and in the space, in general, we're super excited to see this at least go through. You said it's not fully passed yet, but we're expecting it to be. And yeah, we've been digging into it the past couple of days and it's, in my opinion, really exciting. I know some people are hesitant and have questions because it seemed pretty aggressive in terms of the goals, in terms of domestic supply in the critical mineral content of these electric vehicles. But we think it's the right

incentives. We need to start moving faster in providing these incentives and harder regulations and restrictions on where we source these materials from. So I think it's great tailwinds for us and incentives for industry to start using technologies like ours.

Bill Derasmo (13:30):

Yeah. I wanted to tee that up because it seemed like a really important issue. And I know we're all still trying to figure out exactly what it's all going to mean, but certainly directionally, I guess I would say, it seems to be going in a very favorable direction for a company like yours and for your technology. So that's probably an exciting development for you. I'll shift gears again, in reading up on what you do as a CEO, you mentioned that you have to be engaged in fundraising capital, which anyone who's involved in a newer company understands. So pretend we're at a conference, and I'm one of the money people, give me your elevator speech or some version of an elevator speech.

Megan O'Connor (14:09):

All right. Depending on who I'm talking to, Nth Cycle has developed a new way to refine the critical minerals that we use in all of our products from consumer electronics, to all the clean energy technologies. We simply don't have enough of them, and we get them from places around the world that are undesirable for a variety of reasons. So Nth Cycle has developed a new way to refine these here in North America and Europe to provide a very secure supply chain. And we not only do this to domesticate our supply chains, but we can also do it at a reduced cost. So we save 75% in terms of OPEX, as well as reduce the carbon footprint of these critical minerals by 75%. So it's a much cleaner way to produce all of the energy that we need for the future.

Bill Derasmo (14:52):

Well, Ms. O'Connor, you make a compelling case and we're very interested in investing in your company.

Megan O'Connor (14:58):

I wish it was that easy.

Bill Derasmo (15:00):

Don't we all? I always find that part of it interesting. As you know from past episodes, we've had a lot of entrepreneurs on and we always like to dive into the details of their company and their technology and everything else, but there's a practical side that involves exactly, as you say, being able to talk to the venture capital people, private investment community. And I can imagine that takes up a lot of your time and attention.

Megan O'Connor (15:24):

It does. And I think we've been very fortunate to find a really great group of investors and the folks on our cap table who really believe in what we're doing and see how much this is needed. And we're very lucky in that sense.

Bill Derasmo (15:36):

Very cool. Very cool. I looked at Nth Cycle's Instagram account, and I gather from a couple of posts that you enjoy distance running and working out on your Peloton. Both of those activities are near and dear to my heart. So, tell me how you got into running and cycling, and what your typical week looks like in terms of training

Megan O'Connor (15:57):

I think this week is unique because I'm actually tapering because my next marathon is in three weeks. So this is a pretty tame week for me, which I'm very excited about. It's been brutal training in this heat wave up here in the Northeast. But typically, I like to work out six times a week. I see all my zen time in the morning. It's like where I get up, I have my coffee, I pet my dog, and I go on the Peloton, or I go out for a run, and it just helps me clear my mind before I go into the office. So, I'm that person that I get up super early, but you won't see me in the office till about 9:30 because I spend most of my morning outside or in the gym.

And it's funny, I got into cycling specifically for not the reason I think most people would think. I loved cycling. I don't cycle outside actually with people. [inaudible 00:16:37] your finger at me for. I like cycling indoors on a stationary bike, but I did it to actually become better at public speaking. I was a terrible public speaker when I was younger and a lot of people gave me the advice to go and take a theater class or something like that, where you just have to come out of your comfort zone and speak loudly and clearly. And I was like, "Yeah, that's not really me." But what can I do within exercise that can help me do that? And I was like, "Oh, maybe if I taught spin, sitting in front of 40 people and having to project your voice and direct people and be really enthusiastic for an hour at a time, I thought, 'Okay, let's try this.' And I think it worked, I'm pretty loud now."

Bill Derasmo (17:11):

So you were actually a spin instructor then?

Megan O'Connor (17:13):

I was a spin instructor for many, many years. I just gave it up a couple years ago and I could no longer do both jobs. I do love it though. I hope I can get back to it someday. But that is the really weird story of why I started in spin and ultimately got a Peloton. And I love seeing all the instructors because I know how hard it is. And it's just amazing what they do every day.

Bill Derasmo (17:32):

See, now that is... You're not going to get that kind of information anywhere else, except on a podcast like this.

Megan O'Connor (17:32):

That's right.

Bill Derasmo (17:38):

We learn something new here. Megan is actually an ex-spin instructor and she wants to return to it someday. That is very interesting. I have to say, I have big respect for those spin instructors too. I am a

distance runner first and foremost, and I'm always like, "Pfft, cycling, whatever." And then you try to do one of those classes, and you're wiped out afterwards. So, if you do it the right way, it could be pretty challenging training. But I'm right there with you on both of those activities. I do cycle outside more than I use the Peloton, but I have a Peloton in the basement because it gets pretty cold in the East Coast during the winter, so we have that option as well. It's been great to have you on the program, Megan. We really appreciate you taking the time. We look forward to following Nth Cycle's growth. I'll give you a chance, anything else you want to share with the audience? Anything else about Nth Cycle or how they can either get in touch with you or your company?

Megan O'Connor (18:29):

Yeah, I think I'll say we have lots of job openings. We're looking for a couple folks for our commercial team. If you're interested, we have a marketing position open, and we're looking for a lot of great engineers. So if you're interested, please visit us at NthCycle.com and send your resume over. And we're very excited to get passionate people in climate to come work for us.

Bill Derasmo (18:47):

We're hopeful that you're also looking for good lawyers. So, keep that in mind.

Megan O'Connor (18:51):

Always.

Bill Derasmo (18:53):

Always. All right. Thanks very much. We loved having you on the program and hopefully, we'll keep in touch with you as your company grows.

Megan O'Connor (18:59):

Absolutely. Thanks so much, Bill.

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