

Bonus episode: All this is happening at Northvolt speed

The following is the script for the Mark Peplow's audio story about Northvolt for C&EN's Stereo Chemistry. We have edited the interviews within for length and clarity.

Matt Davenport: Happy new year, *Stereo Chemistry* listeners. This is Matt Davenport and I wanted to let you know that we're going to be trying some new things to kick off the podcast in 2020. Now, we're still going to have the monthly, in-depth episodes that you're used to. But we're also going to be bringing you some shorter, bonus episodes.

Just because the episodes are shorter, that doesn't mean we're going to sell you short on important details or analysis. In these bonus episodes, we want to take you behind the scenes a little more. You'll be hearing more from our reporters and the chemists they talk to while reporting stories, covering conferences, and even touring labs.

In this first bonus episode, you'll ride along with Mark Peplow, a C&EN contributing editor. Late last year, Mark toured a new battery company's R&D facility in Sweden. That company, called Northvolt, aims to produce the world's greenest lithium-ion batteries, to help meet the growing demand for electric vehicles.

Northvolt will build these batteries at a gigantic factory—in fact, it's called a gigafactory—and that's currently under construction. But it also has a smaller pilot facility where operations are already ramping up. That's where Mark went to learn more about the company, its work, and its goals. And lucky for us, he brought his recorder.

Mark Peplow: So when will this actually be up and running? When will this be putting out batteries?

Northvolt employee: We will be operational by the end of the year.

Mark: Welcome to Västerås in Sweden. I'm Mark Peplow and I'm here to get a tour round the research and development center of Northvolt, a new battery company. As you could hear from the construction traffic, they're just putting the finishing touches to their pilot line.

Northvolt aims to build Europe's first homegrown gigafactory for lithium-ion batteries, most of which will end up powering electric vehicles. At full tilt, the factory will churn out 32 gigawatt hours of energy storage capacity per year, which is enough for more than half a million fully electric cars.

The gigafactory is actually being built about 700 km north of here in a city called Skellefteå. But the details of the chemistry and materials science that go into the batteries are all being worked out here in Västerås.

Now, gigafactories aren't a new idea. The electric car maker Tesla already has a gigafactory in Nevada making around 24 gigawatt hours of batteries per year. What makes Northvolt different is that its factory aims to make the world's greenest lithium-ion batteries.

You see, every stage of battery production comes with an environmental cost, from mining raw materials right through to disposing old, worn-out batteries. Northvolt aims to reduce those impacts. Its gigafactory will run on hydro electricity, for example, and many of its raw materials will be refined close to where they are mined. That means they can avoid a lot of the CO₂ emissions associated with shipping unprocessed ore halfway around the world.

Northvolt is also developing chemical recycling processes that will eventually allow them to recover a lot of their raw materials from spent batteries. Here's Emma Nehrenheim, Northvolt's chief environmental officer.

Emma Nehrenheim: When we started this company, we decided that this would be a battery where we take on the challenge of building a new industry in Europe. So first and foremost, we decided that we would take more of the production under our own umbrella so we cut the supply chain and we can decide how we supply the power to a larger part of the overall production.

Mark: Now this is important because the world is about to massively ramp up electric vehicle production. Roughly 1 million electric cars were made globally in 2017 but that's expected to rise to about 30 million per year over the coming decade. So that means lithium-ion battery production is soaring as well.

At the heart of Northvolt's batteries is a cathode material called lithium nickel manganese cobalt oxide, also known as NMC. To find out more about how these metals are transformed into working batteries, I got a tour of the pilot plant with William Steel, part of Northvolt's communication team.

William Steel: We will bring in the metal sulfates in bags and that gets put in for a precursor production and crystallization into large tanks. Then goes on to calcination and at that point you're adding in ammonia and sodium hydroxide. It gets calcinated and you transition over into a slurry mixture.

Mark: That slurry mixture is then coated on a very thin metal foil, which is basically the backbone of the electrode, and then baked in a gigantic oven.

William Steel: Then as we pass along here we have the ovens.

Mark (at Northvolt): So what? This whole section here, this whole solid block, is all one continuous oven, is it?

William Steel: I believe it is it partitioned and segmented. But essentially, yeah. This is all oven.

Mark: Wow. So it's at least 20 m long I guess.

William Steel: Yeah.

Mark (in studio): Once the coated foil comes out of the ovens, it's wound up on huge spools to make what is called a jumbo roll. Then it's given a squeeze to make sure the material has just the right amount of porosity—that's an important factor in how well it performs inside a battery.

William Steel: Essentially what you're doing is running the jumbo roll through, you're unwinding it and it's being pressed between two very large rollers.

Mark: After that, the jumbo roll is sliced up and vacuum dried so that the electrode materials are ready to be fitted into a single battery cell. This plant can make prismatic cells which look a bit like a big aluminium brick and it can also make cylindrical cells.

Mark (at Northvolt): So these look like metal shotgun shells.

William Steel: That is correct. So this is a 21-70 cylindrical cell. It's 21 mm across and 70 [mm] in length. And this is a fairly standard cell format. This is one of the areas where we have a good deal of automation that we've engineered ourselves.

Mark: And this system looks incredibly mechanized.

William Steel: It is.

Mark: It look like it's a huge process line.

William Steel: It certainly is.

Mark: And what's coming out the end, then, looks pretty much like a finished cylindrical cell or very nearly.

William Steel: You would have—apart from the cap here. Cell's will then go through here and in for electrolyte filling. And it's essentially filled up and measured by weight to ensure you have the right volume in there. And you'll notice as well that we've marked it.

Mark (in studio): That marking is a black and white patterned square, a special type of barcode known as a QR code. Every single cell that comes out of here gets its own unique QR code, and some of the components inside are also tagged like this using laser printing.

Mark (at Northvolt): So, go on, tell me how that's going to help you. What are you going to do with that QR code?

William Steel: Well, it starts really with traceability for the sake of quality control. If we're able to understand and tag all of the environmental factors surrounding the coating of a particular roll, jumbo roll. But then also all the subsequent steps thereafter. The workforce, who was on the floor that day, what was the ambient temperature. Then when you get towards a final product, when you're looking at its performance or deviations away from that performance, if you can back trace it and understand and then correlate what were some of those variables, in relation to performance, you have a much greater and higher level of understanding.

Mark (in studio): Northvolt's pilot line covers about 19,000 m²—that's about the size of an Ikea store—but it's a baby compared to its gigafactory in Skellefteå. Building work started there a couple of months ago, and it will eventually cover 500,000 m². That's more than 100 American football fields.

The gigafactory is scheduled to start producing batteries in 2021, which sounds like a very ambitious timetable. Still, this pilot plant didn't even exist a year ago and it's set to be operational by the end of the year.

I met with Paolo Cerruti, who co-founded Northvolt and is now the chief operating officer, to ask him how this was all coming together so quickly, and how his firm plans to compete with battery giants based in Asia.

Mark (at Northvolt): You told me earlier that all this is happening at "Northvolt speed." What is Northvolt speed?

Paolo Cerruti: You visited the site today. We started building that site about 10 months ago. And you have seen the complexity of that plant and how much types and layers and secondary steel structure there is.

We are fighting against the clock because there is clearly a time window where there is a need of more capacity on the market. So this has been an Asian game for three decades and it's only becoming now a European game. And we are fighting with people who are substantially bigger than us. They have substantially more amount of money than we have. So it can be a little bit David against Goliath type of game.

Mark: Like who? Who are the rivals?

Paolo Cerruti: Take SDI. Take CATL. Take LG. Right? These are very large conglomerates, especially LG and SDI, which have a very huge base of assets of competences and histories. So you have a ton of respect for these companies. Where we think we are different is that we run very fast.

Mark (in studio): For *Chemical & Engineering News*, this has been Mark Peplow.

Matt: Thank you so much to Mark Peplow for sharing that story. If you want learn more about Northvolt, be sure to check out Mark's [excellent feature story](#) in C&EN. We've got a link for that in the description for this episode.

And we owe a huge thanks to you, too. The listeners, for listening. We really want to know what you think of these shorter-format bonus episodes, so please do not be shy about reaching out with your feedback.

You can tweet at the magazine, @cenmag, or at me, @MrMattDavenport. Or you can email the whole C&EN multimedia team at cen_multimedia@acs.org.

Then be sure to subscribe to *Stereo Chemistry* on Apple Podcasts, Google Podcasts, or Spotify to make sure that you don't miss anything. We're going to have several more bonus episodes for you in early 2020, along with our full, in-depth episodes. In fact, the first full episode of the year will be coming your way next week.

In this bonus episode, you heard the songs "Malibu" by Boheme and "Betula Lenta" by Shahar Haziza.

Thanks again for listening.