

**MICHAEL BRUUN:** Good afternoon and welcome to Talks at GS. I'm Michael Bruun, a Partner in our Merchant Banking division. And I'm delighted to be joined today by Peter Carlsson, CEO and Co-Founder of Northvolt. Peter started Northvolt in 2016 after spending six years as Head of Supply Chain for Tesla. Northvolt aims to transform the supply chain for electric vehicles in Europe and drive our transition to e-mobility powered by renewable energy.

Peter, at the core of your business today is the lithium-ion battery and mostly to power electric vehicles, but also for other usage. What makes the product so unique? And why is the battery at the center of so much of the conversation when it comes to sustainability and transportation?

**PETER CARLSSON:** Well, I think if I take Europe and look at Europe's, basically, commitment to the Paris Treaty, which requires an 80 percent CO2 reduction over, basically, three decades, if that should happen, Europe needs to massively change to major industries. One is transportation, where you need to basically get oil out of transportation and replace it with, primarily, electric vehicles driven by batteries, maybe some fuel cells, but primarily driven by batteries. So, transportation is one. The second one is energy generation, where if we should go where we need to go, we need to take out coal. We need to take out oil. We need to take out natural gas. And we need to replace it with renewable energy.

And for every one of these steps that we're doing, we're increasing instability on the grid. So, the holy grail in that transformation is the ability to store energy. To store energy when the wind is not blowing or when the sun is not shining. And this will be several different paths of storage energies, but batteries are going to be a key enabler of this transformation.

So, the kind of core of this comes into energy storage and batteries. And Europe, as well as the US, basically don't have any significant supply chain of these products. And this was the basis which we started this journey on.

**MICHAEL BRUUN:** It definitely seems like the ESG trends or the sustainability trends have been reinforced by COVID. Maybe we saw the clear blue skies that people were seeing that reminded them of the importance. But just if you look at Europe and the Nordic region in particular, it seems that they have really, also during COVID, but also for a longer period of time now, been leading the way in sustainability. Can you talk a little

bit more about what is it about the environment, the culture in those Nordic countries that make it so favorable to doing what you are trying to do in terms of building a real sustainability leader in the Nordic region in Europe?

**PETER CARLSSON:** We have a unique opportunity to be drivers in this transformation and show the rest of the world how a green transformation can be done out of the reasons that we have a very, very favorable energy mix to start with. So, our starting point is, like, ten times better than compared to, for example, Poland, you know, where you start with a very, very heavy dependency on coal. Here we start with a very, very heavy dependency on renewable hydro power. So, I think the combination of values, but also the combination of a great starting point are the key things that I think we will go the way [PH]. And I think this is also an opportunity where the Nordics maybe should take a little bit more of a leadership role in the European union that have been [UNINTEL] so much of France and Germany think of leading the way. And that where, you know, the Scandinavians have been kind of a little bit resisting and a little bit kind of don't want the center of government. But this is a unique opportunity to show leadership.

**MICHAEL BRUUN:** If you think about the EV and in particular the battery supply chain, how long do you think it will take? And can we, from a European perspective, replace the supply chain that is currently relying heavily on other regions? And I'm not saying we have to replace the supply chain, but obviously we think that you should play a big role in the supply chain. It would be great to get your perspectives on what has been playing out and the future on that topic.

**PETER CARLSSON:** So, it's been pretty clear from the start that the regions are going to be supplied by regional factories. And then it's much more a question, is Europe and the US going to be supplied by Asian factories? Or is the US and Europe going to be able to get enough regional ecosystem? And obviously, this has pretty huge implications on the region's economical growth. And the reason why I'm saying that is, you know, a European ecosystem or a US ecosystem, as well as an Asian ecosystem, starts from research and development. You have R & D. You collaborate with universities. You collaborate with suppliers on material development, on equipment development, et cetera. And you do that in your region. And the financial benefits, when you're building that economic system, is so much bigger in the total effect than if you just have the factory. And I think this is what the European community, this is what we're now starting

to see where there's just a huge focus, also what's called with the European Battery Alliance, to do everything in its power to build that. And this has obviously been a big benefit for us.

Is Europe and the US going to succeed? Yes, I think we're going to succeed because, actually, what we think we've found is a formula where we can build a battery by doing certain vertical integration at scale where we can utilize some of the benefits that Europe brings, which is a surplus of renewable energy at a very, very affordable cost, specifically in the Nordics. And at scale, energy versus labor, energy becomes more important. Labor becomes less important. And raw materials, we're all kind of fighting on the same LME commodity market [PH].

So, I think we are onto an operation model that could really be working here. And right now it's just for us to execute. And I think for anybody who looks at the Tesla Battery Day last week, kind of also saw Elon and Drew outlining very much a similar strategy and thinking that we are applying, which is a holistic view that it's not just a single battery that will allow us-- that we create a magic. That there is a holistic view from supply chains, from raw materials, from manufacturing efficiency, and chemistry evolution that will altogether drive this industry forward.

**MICHAEL BRUUN:** So, just on that note. Obviously, I watched the Battery Day as well. And one of the things I saw there was also the recycling part of the whole equation. Do you want to talk a little bit about that? Because just on the ecosystem piece, that's obviously becoming incredibly important for this industry as well.

**PETER CARLSSON:** For us, this was a very important topic from day one. We put some really strong engineers that worked together with a couple of universities on the topic of recycling and came out with a methodology where we basically could crush used batteries into a black powder and then we use a hydrometallurgical separation process, again, that requires quite a lot of energy, to separate the raw materials.

And because we have chosen a business model where we do a vertical integration of active materials, so that the material that we put in the anode and cathode, it means that we can build a truly circular economy. So, you know, we delivered a battery towards a customer, an automotive company. And then ten years down the road, or 15 years dependent on the user, we then bring that battery back into a logistics flow. We build a new battery.

And we can basically find a fully circular business model with our customers in this. And we're super excited.

So, it was a part of this funding we did during the summer, is building our first scale up facility, roughly four gigawatt hours [PH] of full recycling capability up next to our factory. And our long-term ambition is to go roughly 50 percent in ten years of recycled versus prime material. We think that is doable. And we also think it's making, hopefully, economical sense. And not, at least, the sustainability aspect. I mean, the amount of energy and the carbon footprint of the recycled materials is significantly lower than the prime.

**MICHAEL BRUUN:** Where do you actually see your business in five years from now? What is it that you're building towards? And you can talk about the ten-year perspective as well. But if we were having this discussion in 2025, what will you be talking about? What would this look like?

**PETER CARLSSON:** Well, I mean, you can talk about ten. You can talk about five. You know, what we're doing in ten years is actually initiated within the next five years given the lead times of factories, capacities, and the speed of the automotive industry, et cetera. But what we think, you know, roughly, globally there was somewhere between 200 to 250 gigawatt hours produced of batteries in 2020. We think that that number in 2030 will be over 3,000 gigawatt hours. So, you know, 12 to 15 times.

We think that the European market in this, which is where we focus right now, that might change in the future. But right now this is our focus. The European market will at least probably be 20 - 25 percent of the global market. Maybe more. So, you know, give or take probably around 800, maybe 1,000 gigawatt hours, but at least 800. So, if we want a major share in this market, 15 to 20 percent market share, we need to build roughly 150 gigawatt hours. And you know, building half a gigawatt hour right now outside Stockholm and having a tremendous challenge in fine tuning the processes, I mean it's always the hardest when you start production, you know, 150 gigawatt hours seems like a crazy big number. But then, you know, obviously Elon came last week and kind of made it look like a mice step [PH] when he's talking about three terawatt hours.

But we think that, you know, if we can go from where we are now to 150 gigawatt hours, that's a pretty damn fantastic job in scaling up. And in order to do that, that basically means that, you know, we have one plant, big, in northern Sweden. We have a

second one in Germany. But we need to initiate two or three major giga factories more in order to support that. And that needs to happen in between 2022, '23, '24, '25, maybe '26 in order for that all to come together.

So, the ability to take these factories and almost, like, Ikea warehouses build small blue boxes, it's a little bit more complicated than the Ikea retail stores. But to be able to do that, I think, is a fundamental critical thing in order to succeed here. And we're putting quite some effort into trying to figure out what is the perfect blueprint to kind of just create multiples of factors and manufacturing blocks.

**MICHAEL BRUUN:** And obviously automotive is at the forefront for scalability reasons. But what other industries do you think will adopt this in the five to ten-year timeframe? Who will be your customers in addition to all the big OEMs that you're servicing at this moment in time?

**PETER CARLSSON:** I mean, the market in which we are super excited about this is obviously the energy storage market where I think we're just in the beginning of a major overhaul where the whole energy market has gotten a new toolbox, or basically a new tool in the toolbox, which is the ability to store energy. And I think that, as we're putting more in wind, as we're putting in more solar, the balancing there is going to be very, very important.

But then comes the next thing in the energy market. And that is when we're more and more electrifying our transportation and other pieces where we currently have diesel generators or diesel engines. What this is going to lead is a tremendous pressure on the grid. And I can just take Stockholm as an example. Stockholm has 40 percent of its time, the Stockholm electricity grid is maxed out. It's at the maximum. The day when we have transformed maybe 25 - 30 percent of the car fleet, that could happen easily within ten years, probably faster. That means that if you look at peak hour, Stockholm needs to almost double the capacity within the grid. Which is only doable in two ways. One is that you dig up the entire city and you put massive amount of copper cables in order to facilitate that. Or you're starting to build in energy storage which you bring in energy during lower consumption hours and you utilize that for charging these vehicles during the high consumption hours. And obviously, it's going to be a combination that I think we've just seen the beginning of this transformation. And I'm super excited about the business opportunities that come with that.

Then, again, everywhere where we have a combustion engine, whether it's the lawn mower, whether it's our boat, whether it's in our construction equipment, you know, eventually these are going to be transformed into electrical solutions. Why is that? Well, you know, it's going to be regulatory. But it's also so that an electrical power train, an electrical drive unit is, like, two to three times more energy efficient than a combustion engine. So it just makes total sense to take that step as a society. And which will also, you know, drive a lot of business opportunities here going forward.

**MICHAEL BRUUN:** Peter, let's end on that note with, you know, transparency and sustainability. Thank you so much for joining us. It's been my pleasure in hosting you this evening. Thank you.

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