

Building a battery industry for Europe

Manufacturing | By now, everyone's heard of Northvolt, the Sweden-headquartered startup founded by former Tesla exec Peter Carlsson, building 150GWh of lithium-ion battery factories in Europe. But while investments and off-take deals from the automotive industry have rightly been a major focus of attention, its stationary energy storage division Northvolt Systems has a story to tell too. By Emad Zand, president, Northvolt Systems.



At Northvolt Systems we're working for a clean energy future by contributing to the establishing of a new industrial base for lithium-ion battery solutions in Europe.

Just as we've seen with developing a renewable energy industry, fostering a domestic battery energy storage industry not only represents a significant economic opportunity for Europe, but security of supply for a technology that is a linchpin in the transition towards clean energy.

Establishing this new industry isn't straight-forward and there are certainly challenges in developing the necessary components for a world-leading, sustainable supply chain, but we're further along than people might think. From our perspective, Europe holds all the right ingredients to become a global leader in battery energy storage solutions and it has every reason to embrace this opportunity.

The evolving European landscape for ESS

It's fair to begin with acknowledging that while battery energy storage remains a young industry within Europe, it is one full of promise and potential.

The potential stems from the idea that Europe holds all the right competences to support a complete, globally competitive battery storage supply chain. By embracing the opportunities of this new industry and driving them to their full economic potential, Europe could very well become the leading global supplier of battery energy storage to a global market forecasted to attract some US\$262 billion in investment out to 2030.

Many in the energy industry recall how 15 years ago Europe was tipped for leading the solar PV industry. But for reasons including lack of engagement from industry, as well as from governments and the EU to create favourable conditions,

Northvolt might be best known as a cell manufacturer for the automotive industry, but it's also a producer of whole battery systems for two distinct market segments: Industrial and Grid.

the opportunity was lost. It is precisely this which we must avoid with the battery industry.

To the promise, we need look no further than case studies of deployed energy storage systems (ESSs) for evidence of what the technology can do to quicken the adoption of clean energy and enable the transition away from fossil fuels. And indeed, there are even pioneering European ESS companies operating within this landscape – albeit with cells and batteries sourced from Asia, the long-standing home of the lithium-ion battery industry.

The relative immaturity of the ESS industry can be understood for two core reasons. First, since the region has historically lacked upstream cell production, it has not been in an ideal position to foster either battery competence or synergies in battery solutions.

Second, while theoretical need for energy storage has been recognised for

some time, the realisable market demand has lagged behind. Clear market structures and reliable revenue streams for the operation of ESS are a prerequisite for business-case viable projects, but they also serve to encourage investment in components of industry itself, including components suppliers and developers.

To both points – the location of cell manufacturing and the viability of ESS – we see change that leaves Europe not only well-positioned and motivated to mature its ESS supply chain, but to lead it.

Europe is well underway in scaling up its cell production capacity: long-time champion of the European battery chain, European Commission Vice-President Maroš Šefčovič, has stated that by 2025 Europe will be the second largest producer of batteries in the world and supplying almost 90% of its domestic battery production needs.

In parallel, markets have become more favourable for energy storage deployments. To be sure, some markets are further ahead than others, certainly the UK and Germany can be highlighted in this respect; but broadly we have the right foundations which are strengthened by EU commitments to decarbonisation.

There are of course still challenges for the European supply chain, but above all there is opportunity. It is telling that in acknowledging the need for its own proactivity towards batteries, the US government has recognised the approach of Europe towards fostering a domestic battery supply chain. The acknowledgement is well-earned. The EU has a proven track-record for nurturing its battery industry – focussing on cell manufacturing, upstream materials preparation and recycling.

Embedded within the EU's approach is a particular focus on calls for sustainability within the battery industry. This is prudent – positioning the new industry to leverage what can become a differentiating factor for European products. On this front, new legislation currently under development in Brussels, namely the Battery Directive, is key.

The European Commission's Battery Directive proposals are well-aligned with what Northvolt strives towards. Notable highlights include mandating of carbon footprint labelling, new procedures to ensure ethical sourcing of raw materials and ambitions for battery recycling. Stakeholders to the emerging European battery landscape should embrace sustainability from the outset.



Northvolt's first grid-connected battery system, Västerås, Sweden

Credit: Northvolt

BloombergNEF forecasts installations in the order of 1TWh of energy storage by 2030, with much allocated for Europe. Beyond the value of directly enabling these European deployments, the real opportunity is for Europe to become home to leading ESS developers supplying the global market, much as we see with wind power and energy efficiency technology.

With the right approach, in time what we could come to see in the European battery energy storage industry is a textbook example of the environmental, societal and economic gains to be secured in repositioning industrial might in manner aligned with demands of a world facing a climate emergency.

Scaling for an energy revolution

When we set out to begin developing battery systems there were few European companies engaged in the grid-scale battery solutions ecosystem. The few players out there were invariably operating in high-end, niche fields, designing for small orders at high cost.

What we envisioned was quite different. At Northvolt, we're in business of accelerating the shift away from fossil fuels. As it is with developing cells for the automotive industry, building a successful ESS industry in Europe requires safe, high-performance products, scaling manufacturing and cutting costs. This philosophy has shaped our approach, both in terms of product design and developing manufacturing capacity.

At the same time, this thinking determined strategic positioning towards the supply chain itself. And we faced challenges here. Europe didn't have a supply chain full of players with proven track records in delivering to large-volume, battery systems development.

Accordingly, we've taken an unconven-

tional approach to seek out competences rather than products. What that means in practical terms is that many of our suppliers are not traditionally battery component suppliers. Instead, we've aligned ourselves with groups possessing the right manufacturing and technical competence, together with an attitude for growth and adaptability that matched our own.

This approach has been successful for key components including mechanics, electronics, and thermal solutions. We've found great partners with the right competences, and with a few exceptions our supply base is European. And this shouldn't be surprising – Europe, after all, might not always be able to compete on cost against Asian manufacturing, but what it does have is high-end competence to build to specification, to certification, and build well.

And this is just what is required in a battery system. These are sophisticated products after all, which must be built according to rigorous safety and quality requirements.

In part, the strategy worked because of how we've scaled the team at Northvolt Systems. In keeping with Northvolt's tendency towards consolidating verticals of the cell supply chain within its own activities, Northvolt Systems has built up specialised competences for systems design, development, testing and production in-house, leaving dependency on outside suppliers only for select components.

Localising supply chains

Selecting for European suppliers is key to strengthening the supply chain in the region. First and foremost, it enables these companies to build up experience with battery systems products and enhance their competitiveness. Relatedly, supplier visibility on their role to play in contributing to the industry will encourage their

own investment in necessary equipment and dedicated facilities to support the industry and expand their capacities.

Additional benefits stem from localising the supply chain too. The alternative is a reliance on distant component suppliers. Aside from the increased environmental footprint associated with this, what the Covid-19 pandemic demonstrated was the very real risks associated with trans-continental supply chains. Given the opportunity we have in Europe to build up this new industry from scratch, it would be a mistake not to embed sustainability and resilience against supply chain disruption within it from the outset.

Again, we can highlight that EU policy and ESS markets are moving in the same direction as the EV market – with both OEMs and end-customers starting to look under the hood of the cell and whole battery system. All players in the ESS ecosystem have a role to play in ensuring sustainability and transparency of their products; and developing the local value chain is crucial to securing this.

Safety and sustainability

Within ESS, the cell is key. As mentioned, Europe has proven itself swift to establish a domestic cell supply and this continued focus provides a springboard to developing a robust ESS industry, which lies downstream of cell manufacturing but prospers from synergies arising when the two are geographically localised.

Northvolt Systems will source lithium-ion cells from Northvolt Ett, the battery gigafactory, located in northern Sweden. As a battery systems developer we have several requirements for cell supply. Low cost being a prerequisite, safety would be the next fundamental. The emerging European ESS supply chain cannot be relaxed towards this point – we've seen examples of what happens when battery systems fail.

Fortunately, this is an area where Europe can excel and set the global benchmark for safety in battery systems. Assurance on safety of battery systems is already a hygiene factor for customers, and rightfully so. It's worth noting that aside from physical design providing a route to safety, digital technologies provide a powerful toolbox to be leveraged in pursuit of safe systems.

Digitalisation is prioritised at Northvolt Systems, and we have a dedicated software team developing what we term Connected Battery digital architecture. We see that software not only enhances safety of systems but is vital to harnessing the full potential of batteries across the multiple applications they can serve for their full lifecycle. Connectivity enables optimisation of cell and module performance, reduces the need for reactive maintenance and is altogether the backbone to lowering total cost of ownership over the lifetime of the system.

Beyond safety, we prioritise sustainability, that's to say having both a cell that carries a low environmental footprint and transparency on its raw materials. As mentioned, European policy will begin demanding this. But so too will ESS customers. It's therefore critical for the battery systems supply chain to already today be planning for this future. Ultimately, like safety, sustainability can become a valuable differentiating factor for the European ESS industry and strengthen its competitiveness.

Build to cost, build to scale

For the European ESS industry to scale towards global leadership, it's critical to design both manufacturing and product technologies to enable competitive pricing. For this, one insight we've had is the importance of modularity. That is to say, designing a base module for integration

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into packs and systems that can easily be scaled with minimal additional design requirements or components.

The aim to design products for scalability extends to how we deliver new manufacturing capacity. Here too, we can be smart in how we establish factories. A balance must be found between CAPEX and OPEX. There is an unavoidable sizeable upfront cost to deliver assembly lines, but we can be smart in selecting machinery and tools, which when paired with well-designed products, is future-proofed for future battery systems products.

Especially on the mechanical and assembly sides, leveraging large-scale manufacturing techniques and methods – which Europe has considerable experience of from other sectors – is invariably rewarded with lower unit costs.

Reflecting what the European battery systems industry can and should become, we can highlight Northvolt Systems Dwa – the battery systems assembly facility under development in Gdansk, Poland. The facility will feature highly automated assembly lines for high-volume production of modules and module-to-pack integration. A port city with excellent road access to the continent, the facility is well-positioned for both inbound volumes of cells from Northvolt Ett and components and for outbound product flows.

Northvolt will invest US\$200 million to build this new battery systems factory and it will become the largest of its kind in Europe. Development is already underway and production is scheduled to begin in 2022 with an initial annual capacity of 5GWh and a potential future capacity of 12GWh.

Batteries are rapidly becoming a cornerstone technology of energy, mobility and societal functioning at large. For Europe to transition effectively to net-zero, it requires battery systems of its own. But the opportunity is much greater. We missed our chance with solar PV, let's not make the same mistake with batteries.

**Northvolt's
Votpack Mobile
System providing
temporary energy
storage**



Credit: Northvolt