

How Europe can win the battery race

10 GWh of advanced batteries by 2025

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Summary

Batteries will play a defining role in the 21st century economy. Vehicles, homes, industry will all transition to electricity and partially or fully rely on battery storage. Europe has made real progress in developing a battery supply chain, resulting in several gigafactories being built (Nortvolt is one example). The EU should intensify its efforts to build a battery value chain in Europe if it wishes to be independent of foreign supply. Efforts to develop next generation batteries should build on, and be integrated into, the existing EU Battery Alliance. Success in advanced batteries cannot be achieved without success in current lithium-ion technology.

As part of its industrial policy, China mandates what products to manufacture and buy; the US innovation model relies on a combination of government funded research (e.g. Arpa-E), government/military procurement and venture capital. Europe is different but does boast a rich industrial value chain with some recent successes in coordination (e.g. the EU Battery Alliance). In addition, the EU is a regulatory superpower, the biggest R&D spender in the world, and its member states have unique fiscal powers.

In order to ensure Europe leads on next generation battery technology, **the EU should by 2025 set a goal to manufacture 10 GWh of advanced batteries with double the current energy density (500Wh/l) and half the current cost per kWh (USD 100/kWh)**. This should be done by giving funding to 5-7-year-long consortia that:

1. Build on the most promising advanced battery tech and partner scientists with engineers from the outset to **design pilot lines and start manufacturing small batches of advanced material**.

2. As exemplified by Northvolt and Volkswagen, consortia should include at least one tier 1 or premium car manufacturer that commits to buying the batteries once they meet the promised performance requirements. **There is no path to success without such offtake commitment.** We do not currently recommend mandating the use of these products, but the upcoming battery, car and other regulations will create opportunities to create more favourable market conditions for advanced batteries.
3. Where EU funding is given to support EU car or battery manufacturers to produce batteries, they should commit **at least 20% funding of that to advanced battery production** within the same capital investment cycle.
4. Consortia must be required to commit to **manufacturing in Europe** for the first phase until production scales up to at least 10 GWh. This should be a precondition of getting EU financing, will create European high tech and engineering jobs and secure future industrial base.

T&E recommendations

China leads the lithium-ion battery technology today, accounting for 73% of global production in [2019](#). But at least a dozen gigafactories - by European and Asian consortia - are planned in Europe, spurred by the fast [increasing](#) electric vehicle market that provides offtake certainty. At least 131 GWh capacity is expected to come on line by 2023. This includes the EU flagship battery maker Northvolt, that recently [announced](#) upping its production plans to 150 GWh for 2030, and the Franco-German consortia [including](#) Opel's cell manufacturing in Kaiserslautern.

But attention is turning to the next big thing beyond the current lithium-ion chemistry - the advanced battery that can match the range of conventional cars, cut the cost and be the safest yet. The first to commercialise this will win the next battery battle and secure the future industrial lead. From metal anodes, to a solid electrolyser or a new lithium-sulfur chemistry, the exact composition of it should be left to industry to figure out. This non-paper outlines T&E's blueprint¹ of what Europe should do to ensure its industry wins the next battery race.

¹ Based on feedback from leading experts in the field, such as the US Argonne Lab and battery companies

1. Nurture what you have (i.e. Northvolt)

The projects that the European Battery Alliance has brought - including Northvolt and the PSA-Saft consortium - are already a great success and should be supported as much as possible. It is not yet a given they will succeed; if they do - manufacturing current lithium-ion technology in Europe as announced is already an immensely great achievement. This will supply EU technology that will be in most cars, vans, trucks and energy applications until at least 2030. Success in this field will create space for new and bold ventures. Failure would have the opposite impact. Making advances into new battery technology should be based on the current champions.

2. Bring new battery investment into the current capital investment cycle by battery manufacturers

Europe has in place structures such as the European Institute of Innovation and Technology (EIT) and Knowledge & Innovation Platforms (KIC) that are at the heart of fostering the new battery players such as Northvolt. The current capital investment into battery manufacturing by such players is made for the next 5-7 years. This spending needs to incorporate chunks to be invested into the advanced technology (as well as deploying the current lithium-ion) so that it is absorbed in one capital cycle. We have the infrastructure, and the expertise, and we must continue to utilize this European ecosystem.

3. 10 GWh is the magic number

Battery experts in the field agree that the magical scale number is 10 GWh - this should be the target for Europe to ramp up in the mid-2020s to lead the market/industrial manufacturing. The flagship target should be **10 GWh of advanced battery cells manufactured/planned in Europe by 2025.**

4. Double energy density, halve the cost

The focus of advanced battery technologies by leading lab and universities is focusing on:

- Better anodes that incorporate more silica or even go to Lithium metal - this significantly increases the activity of lithium atoms, hence increases energy density of batteries
- Replacing current liquid electrolytes (that cause fires) with solid ones (e.g. ceramics or glass) to make batteries much safer
- Current cathodes consisting of nickel-manganese-cobalt alloy (NMC) are likely to have only incremental improvement in the coming years, focusing on reducing cobalt fraction (so Northvolt's planned cathode production is future-proof at least until 2030)

The standard for advanced battery should be set at **energy density of 500Wh/liter, specific energy at over 250Wh/kg and USD100 per kWh**, all at system level. More detail on the battery technology roadmap is available [here](#).

5. Pair scientists with engineers to produce pilot lines

What Europe does well already is funding the best researchers & universities on advanced battery research as part of its Horizon 2020 programme. But what is missing is the longer term link to 1) pilot line and 2) manufacturing (see below). Experience from initiatives such as [ARPA-E](#) in the US shows that scientists have to be from the very beginning paired with engineers who know how to build production lines/produce battery materials in scale. This should be part of the EU funding support from the outset.

6. Pair pilots with Tier 1 car manufacturers to scale up production

Pilots and demonstrations have to be from the beginning paired/partnered with car makers (or power companies) who will be the eventual clients of the batteries. 1st tier car makers - VW, BMW, Renault - are best because they know what batteries they need, how to produce at scale and ensure high quality products. Funding given to advanced batteries by the Commission from the outset has to include top tier/premium carmakers committing to help design & buy the product if it meets the agreed performance requirements.

7. Mandate manufacturing in Europe for 5-7 years

The initial funding for advanced batteries has to come with a 5-7 year route-to-market plan, not annual research grants. It should include a pilot line and the initial manufacturing plan (if the performance requirements are achieved). Crucially, this should mandate manufacturing in Europe for the first 5-7 years, or until 10 GWh capacity is reached/committed, before investment outside Europe can be allowed.

Further information

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