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The EU Battery Alliance

Can Europe Avoid Technological Dependence?

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With the launch of its "battery alliance", the EU is finally taking up the industrial battle with Asia and hopes to meet a large share of the surging demand for electrical batteries. Yet, the clock is ticking and the future of battery manufacturing in Europe depends primarily on the strategies that automakers will adopt.

The right conditions may finally be in place for electric transportation to become a mass market. Hybrid and full-electric vehicles (EVs) still account for a very small fraction of total sales (1% in 2016) but demand is booming and forecasts are constantly revised upwards. Many European countries, as well as India and China, have recently signalled their intention to completely phase out gas and diesel powered cars between 2025 and 2040. In the meantime, charging infrastructures are built with public funds, incentive schemes for the purchase of EVs are extended, CO_2 emissions standards are tightened, minimum quotas for the sales of zero emission vehicles are introduced, and cities are increasingly investing in electric bus fleets. This strong push in terms of public policy adds to a growing environmental awareness among customers – in particular in Europe since the *Dieselgate* scandal – and clearly strengthens the case for ambitious EV plans in the automotive industry. Global leaders in the car industry are now all intending to offer a large part of their models in electric versions, and their EV investment plans amount to at least $90bn[1] (see Annex 1, p. 8).

If automakers stick to their plans, there will be a surge in demand for electrical batteries in the early 2020's. In fact, the global market for lithium-ion batteries (LIBs) is already changing fast; it was almost entirely driven by portable electronic devices until 2010, whereas today the automotive sector represents a comparable outlet in volume (about 32GWh in 2016)[2]. According to Volkswagen's R&D team, the automakers' need could reach 1.5TWh/yr if their sales of EVs reach 25% by 2025.

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Should this really happen, the market opportunity for LIB manufacturers would be tremendous; it would mean building about 40 *gigafactories* comparable in size to the one Tesla and Panasonic are currently developing in Nevada.

In parallel, battery storage will increasingly be used to cope with the intermittency of renewable electricity production, provide system services and defer investments in grid infrastructures. While not comparable in volume to the EV market segment,[3] energy storage applications are still attractive for battery manufacturers, at least in terms of outlet diversification and the optimization of production schedules.

Inevitably, these developments translate into a rapidly growing demand and the conditions to ignite a virtuous circle may finally be met. With increasing sales, battery manufacturers are reducing their costs further thanks to economies of scale and improvements in industrial processes. In turn, they can offer better performance and prices, and ultimately they facilitate the creation of a mass market for battery storage, which is actually expected to represent no less than €250bn/yr in 2025.[4] Now the key question is how this promising cross-sectoral and strategic industry will be structured and who will be the main money-makers along the value chain.

Assembling battery packs is not sufficient: Europe needs the know-how for cell production

While European policies converge in making battery storage one of the central elements in the future transport and energy systems, the incumbent Asian players are clearly in the best position to serve Europe's demand up-take. The European Union (EU) is strong on the downstream part of the value chain, from battery modules and pack assembly to system integration, but cell manufacturing is almost entirely outsourced in Asia. In 2015, there were only nine cell manufacturing sites in the EU and all of them were focusing on small-batch series, unfit for the EV market. By contrast, Japan, Korea and China accounted collectively for 88% of the global LIB cell manufacturing capacity in 2016 and these three countries were also the dominant suppliers for cell components including cathodes (85%), anodes (97%), separators (84%) and electrolytes (64%).[5] Aside from Tesla, which is actually relying on its Japanese partner Panasonic for producing the battery cells, the American battery industry is not performing better than the European one. Significant

manufacturing capacities were built in the United-States in 2008-2010, backed with subsidies from the Department of Energy, but most factory owners went bankrupt because demand for EVs had been overestimated at the time. Asian companies have kept on investing in production capacities, without being bound by short term profitability constraints, and they are now dominating the market. Looking at the number of *gigafactories* projects currently being developed in China, this trend is even likely to strengthen in the coming years (see Annex 2, p. 8).

While complete sealed battery cells can be shipped worldwide, they cannot be considered a simple commodity. Not having a stable and secure manufacturing base for advanced materials preparation and cells production in Europe could actually prove detrimental to the whole EU energy and automotive industries:

- A large portion of the battery value chain would be in the hands of the Asian players because cells represent around 60% of the battery costs. This would also be the case for the total EV value chain since the battery accounts for approximately 40% of the EV production costs.
- Being close to the cells production sites is a competitive advantage for Asian battery/EV makers, since it means lower transportation costs for these heavy products and, even more important, easier quality control.
- Finally, domestic clusters are in place in Asia and they are another key advantage. Although it may not be the case today, cell suppliers may decide to offer preferential contract terms to the battery/EV makers of their own country, at the expense of foreign customers. In the end, European EV makers and energy storage service providers may no longer be able to offer competitive products compared to their Asian counterparts, simply because they have less control on their cell suppliers.

The risks are real, but the investments required to engage in large-scale cell manufacturing amount to billions of euros, and there are only a few years left before demand takes up.

Closing the gap with Asian cell suppliers is actually possible

Since 2015, when Daimler and the chemicals firm Evonik gave up on

their project to produce battery cells in Germany, the dominant view has been that the industrial battle was not worth fighting, at least until EU players can come up with disruptive technologies such as solid-state batteries. This is probably illusionary because the current technology, advanced li-ion cells based on Nickel-Manganese-Cobalt, is expected to remain the chemistry of choice for at least the next decade and it is hard to imagine how a new entrant would be able to jump directly to the mass production of a disruptive technology, at a time when the battery market will be well-established around big players with very large R&D budgets.

There is no doubt that Asian firms are ahead of the curve thanks to their experience in the consumer electronics sector, but their competitive edge in advanced li-ion cells may still be questioned by 2020-2025: actually, recent experience shows that new competitors can enter the battery cell market and acquire a significant market share in a short period of time. The top 3 battery cell suppliers are currently the Japanese Panasonic and the Koreans LG Chem and Samsung SDI, yet they are now seriously challenged by the Chinese contender CATL which was only founded in 2011 and aims to reach a target of 50GWh capacity by 2020. While they are still considered two to three years behind the Koreans and the Japanese in terms of technology, the Chinese have demonstrated that they can catch up fast, based on their ability to leverage on a huge domestic demand, which is supported by public subsidies of all kinds and largely inaccessible to foreign battery makers.[6]

If there is no major technological barrier to entry, then why cannot Europe enter the arms race? In fact, several arguments suggest that it could be feasible because, in the specific case of battery manufacturing, Asia's competitiveness is not built on its most conventional strengths:

- Potentially higher wages in the EU are actually not a major issue because cell production is largely automated, with the aim of preventing costly human errors. Labour costs account for only 10% of the cell manufacturing costs and they come mainly from engineering jobs, for which the salary gap between Asia and Europe is not significant. However, high-skilled industrial engineering workforce is currently lacking in Europe. Promoters of the Swedish-based project, Northvolt, indicated that they could only find Japanese candidates with the requested

competences in the field of applied process design.[7] This said, energy, which actually tends to be more expensive in Asia than in Europe, represents an equal share of the cell manufacturing costs (10%).[8]

- In fact, materials represent the largest share of total cell costs (at least 50%).[9] In this area, Chinese manufacturers do have a strong advantage, but primarily because the Chinese government has a robust strategy for securing access to raw materials[10] and also because they have the possibility to obtain advantageous prices from their suppliers thanks to high purchasing volumes. Although reacting late, the EU could still elaborate a more robust strategy with regards to critical materials supplies through cooperation agreements with producing countries, and also encourage the development of domestic resources as well as the recycling of old batteries.
- Reaching sufficient sales volumes guarantees not only better materials prices, but also and more importantly economies of scale. For Europe, it is a chicken-and-egg problem. Building large capacities to serve the demand up-take requires huge capital investment. For example, the costs of constructing Tesla's first *gigafactory*, expected to produce 35GWh in cells as of 2018, were estimated at $5bn in 2013. Without enough customers' commitments, it is not possible to obtain enough financing and therefore reach economies of scale. However, global car makers will be reluctant to commit without the proof that the project promoter can produce high-quality cells in large volumes without cost overruns or delays.

Catching up with Asian competitors will be challenging but, for all aspects listed above, European competitiveness could be enhanced if public and private stakeholders join forces. Beyond cost-competitiveness, EU players can also push for differentiation and offer added-value, for instance in terms of safety and environmental performance. The point in replacing thermal vehicles by electric vehicles is to reduce the impact of transportation on the environment. In this perspective, it would make sense to value batteries that have the lowest carbon footprint, thanks to local production and thus shorter transport distances for cells, an energy-efficient industrial process, the use of low-carbon electricity and the high recyclability of the final product for example. This would at least help factory

projects located in Europe, but not necessarily projects launched by EU companies.

The EU battery alliance will facilitate investments, yet the ball is still in the hands of EU automakers

There are many potential candidates for large-scale battery manufacturing in Europe, being small battery producers, chemical firms, car manufacturers themselves, industry consortiums etc., and the market is best-placed to decide which of them have the most convincing business case. While it would not make sense for the EU to pick-and-choose or force the creation of an "Airbus for batteries", its role is to set up the right conditions for profitable projects to go ahead (see Annex 3, p. 9). The point is also not to waste public money because it remains unclear how many factories will be needed in Europe, knowing that regional EV market forecasts range between 14 to 24GWh in 2020 and 37 to 117GWh in 2025.[11]

In just a few months, the European Commission has efficiently used its convening power to gauge the needs of all stakeholders in the industry and to come up with a set of action points (see Annex 4, p. 9). If not yet an "eco-system", an EU battery network is now in place. It is already a major achievement because large battery factories can only be launched based on industrial partnerships, at least with automakers who are the only ones able to sign the large supply contracts which will convince investors that the project should be given green light.

Breaking silos, the battery alliance looks at all possible means to improve the competitiveness of EU-based industrial firms, as long as these means are within the competences of the EU and compliant with international trade rules. Among others, an extra budget of €100 million will be allocated in the next two years to R&D projects which are helpful in establishing mass production, for example new cell production pilot lines for validation and testing procedures. A clearinghouse for raw materials may also be set up as a way to reduce supply risks for EU players. A requirement to declare the CO2 footprint of batteries could be introduced and initiatives relating to safety standardization will be reinforced. The idea would be to support demand, but also value criteria that the European industry is best placed to meet, without infringing world trade rules. The question is whether the EU can go far enough and make sure these

legitimate criteria are systematically taken into account, in EV purchase subsidies and public tenders for electric buses for instance. Likewise, complexe trade issues have been clearly indentified at working group levels. the EU should engage in international negotiations, to ensure that EU players are given a fair access to the key battery markets, in particular in Asia.

Many EU financing tools will also be used to facilitate the establishment of a manufacturing base, considering that factory projects would be both innovative and in line with the EU's policy objectives. Besides the EU structural funds, project promoters could easily apply for preferential loans and guarantees on debt financing (*InnovFin*) from the European Investment Bank. Equally important, restrictions on state aid rules would be lifted if the projects are both transnational and of strategic importance. No project will go ahead without private investors being convinced by the business case and thus contracts with car makers being signed, but the joint backing from several Member States and the EU institutions would help close the deal. In parallel, fast-track procedures could be introduced to shorten the project lead times.

In sum, the EU is playing a facilitating role and the ball is now in the hands of companies, and to a lesser extent of Member States. They have to decide whether it is worth joining forces and taking the industrial risk. EU car makers will play the pivotal role and decide which projects, if any, should go ahead by signing supply contracts or directly investing in the factory projects. On the one hand, they have a strong interest in gaining a better control on the battery value chain by favouring battery cells production on the European soil and they will get public support for this. On the other hand, they are global players and they are already engaged with Asian suppliers who have a strong reputation and are also ready to locate part of their battery production closer to the European demand, as with LG Chem in Poland and Samsung SDI in Hungary. Because the clock is ticking, they should clarify their strategy in the next months or so. If they decide to hold back and to rely fully on external cell suppliers, the EU would still develop its strength in niche battery markets and the downstream part of the value chain, but European countries would need to have a frank discussion on whether an all-electric strategy is in line with its industrial, economic and geopolitical interests.

Annex 1

Electric Plans from the Five Largest Automakers

5 largest automakers in 2017	Electric Vehicle (EV) targets	Electric Vehicle investment plans
Renault Nissan	• 12 new EV models on offer by 2022 • EVs to account for 20% of total sales by 2022	
Volkswagen	• 80 new EV models on offer by 2025 • 2-3 million EV sales by 2025 • Entire fleet available in electric and hybrid versions by 2030	$34bn to be invested in EVs and self-driving technologies by 2022
Toyota	• 10 EV models on offer by 2020 • Entire fleet available in electric and hybrid versions by 2030	$13.3bn to be invested in EVs by 2030
General Motors	• 20 new EV and fuel cell electric vehicles on offer by 2023 • 1 million EV sales by 2026	
Ford	• 40 EV & hybrid models on offer by 2022	$11bn to be invested in EVs by 2022

Source : Carole Mathieu, "The EU Battery Alliance: Can Europe Avoid Technological Dependence?", Édito Énergie, Ifri, February 2018.

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Annex 2

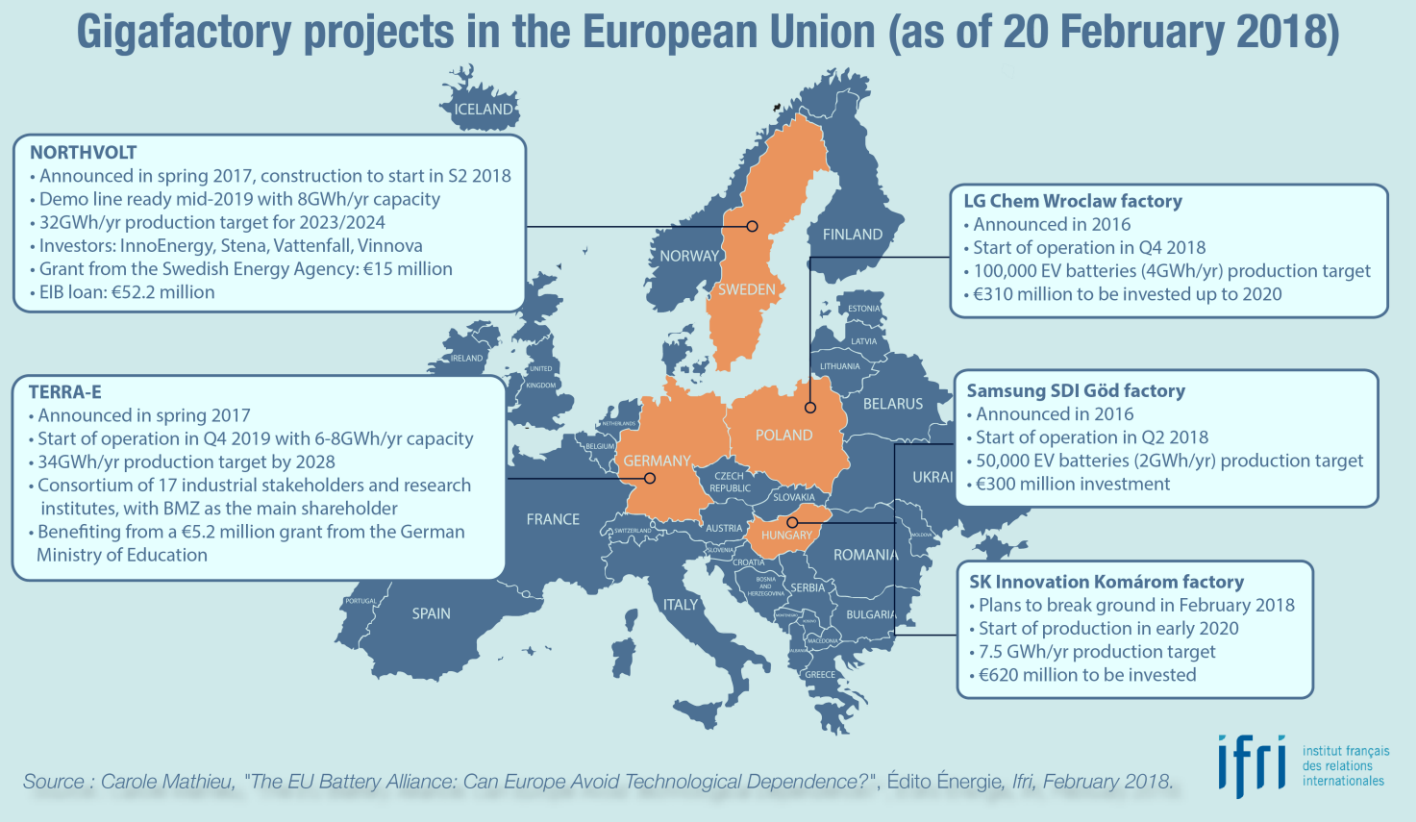
Announced battery cells production capacities for EV and storage applications by 2021

Global cell production capacity in 2017=103GWh

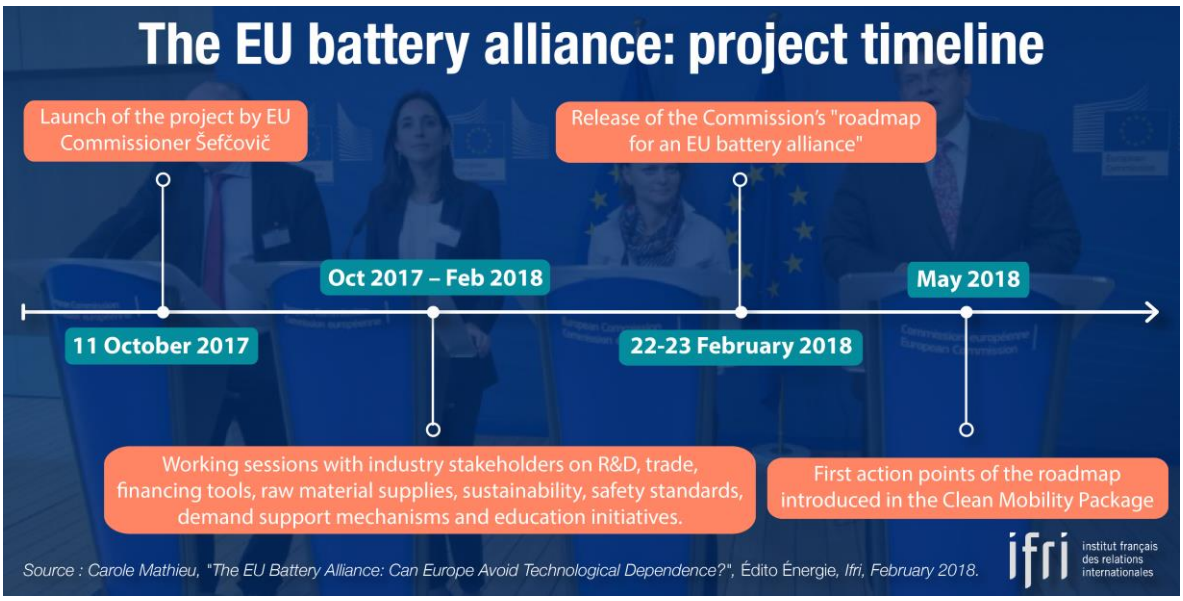
China	120GWh
EU	29.5GWh
U.S.	36GWh
Thailand	50GWh
Australia	15GWh
South Korea	8GWh

Sources: Bloomberg Intelligence, Benchmark Mineral Intelligence and company figures

Annex 3



Annex 4



1. Reuters Analysis, "Global Carmakers to Invest at Least $90bn in Electric Vehicles", 15 January 2018, available at: www.reuters.com.

2. C. Pillot, "The Rechargeable Battery Market and Main Trends 2016-2025", Talk at the Advanced Automotive Battery Conference, 2017.

3. According to BNEF, energy storage applications are not expected to represent more than 10% of the LIBs needed for the transport sector by 2024.

4. Statement by Vice-President for Energy Union Maroš Šefčovic following the high-level meeting on battery development and production in Europe, 11 October 2017, available at: http://europa.eu.

5. D. Chung, E. Elgqvist, and S. Santhanagopalan, "Automotive Lithium-ion Cell Manufacturing: Regional Cost Structures and Supply Chain Considerations", CEMAC, 2016, available at: https://energy.gov.

6. C. Mathieu, "Europe in the Global Race for Electric Batteries", Études de l'Ifri, Ifri, July 2017, available at: www.ifri.org.

7. Statement by Paolo Cerruti, COO, Northvolt AB at the European Commission's workshop on European Battery Cell R&I Workshop, 11 January 2018, Brussels, webstream available at: https://webcast.ec.europa.eu.

8. M. Steen, N. Lebedeva, F. Di Persio, and L. Boon-Brett, "EU Competitiveness in Advanced Li-ion Batteries for E-Mobility and Stationary Storage Applications – Opportunities and Actions", 2017, available at: https://ec.europa.eu.

9. *Ibid.*

10. G. Lepesant, "La transition énergétique face au défi des métaux critiques", *Études de l'Ifri*, Ifri, janvier 2018, available at : www.ifri.org.

11. M. Steen, N. Lebedeva, F. Di Persio, and L. Boon-Brett, *op. cit.*