Centre d'étude des crises et conflits internationaux

Geopolitics of electric vehicles

Towards a European green transition?

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Introduction[1]

The European Union (EU) has set forth its ambition to become climate-neutral by 2050, driving all key sectors towards net zero greenhouse gas emissions. To achieve its climate goals, Brussels sees an opportunity to shift the transportation sector to zero- and low-emission vehicles. While a range of technologies may be envisioned, the current trend is heading towards a more electrically-powered transport sector, ultimately battery-dependent. The research focuses on the most developed technology, the lithium-ion (or Li-ion) battery, which is used in both battery electric vehicle or plug-in hybrid electric vehicle. This article seeks to explain the incentives driving the paradigm shift towards electric vehicles (EV). It also deals with the EU commitment to ensure the recycling of raw materials for battery production, without losing sight of the importance, from a strategic point of view, of ensuring access to the critical raw materials that make up batteries. Ultimately, the study dives into the ongoing race to build large-scale factories for battery cell production in the EU, namely the Giga factories.

1. The shift towards an electrified vehicle paradigm

In recent years, batteries have emerged as a key strategic industry for the future of the EU as an essential feature of the competitiveness of its automotive sector in the move towards more zero- and low-emission vehicles. In this regard, the main purpose of the Strategic Action Plan on Batteries published in 2018 is to bring the EU at the front line as leader in this industry, sustaining jobs in circular economy and clean mobility[2]. The strategy aims to further strengthen the EU's civilian power – its will to civilize international relations and to act as a responsible player[3]. The European Green Deal is the main illustration of such a will as it aims to "*transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are not net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use*"[4].

To live up to its own ambitions, the Union must tackle the transport sector, which accounts for a growing 40% of the EU's greenhouse gas emissions (GES). Within this framework, the Sustainable and Smart Mobility Strategy published in 2020 proposes a comprehensive set of measures to achieve climate neutrality in the transport sector, targeting a 90% reduction in GES by 2050[5]. Measures considered for this shift include multimodal mobility, automatization or balance between transport price and its impact on the environment. Among these, road transport is regarded as a core activity given its significant GES share, around 20% of EU emissions. In consequence, the EU seeks a 15% decrease of CO_2 car emissions by 2025, 55% by 2030 and 100% by 2035. Whilst several technologies exist, the present tendency is to move towards a more electrified and battery-driven transport sector. This move requires, according to the European Commission, the availability of 1

[1] The authors would like to thank Dorothée Vandamme for her diligent proofreading and wise advice. She has greatly contributed to the improvement of the present analysis.

[2] EUROPEAN COMMISSION [EC], *Europe on the Move. Sustainable Mobility for Europe: safe, connected and clean,* May 17, 2018, *Annex 2: Strategic Action Plan on Batteries*, p. 1.

[3] SMITH K., "Beyond the civilian power EU debate" dans *Politique européenne*, n°17, vol. 3, 2005, p. 66.

[4] EC, *The European Green Deal*, December 11, 2019, p. 2.

[5] Ibid, p. 10.

million charging station by 2025, 3.5 million by 2030 and 16.3 million by 2050[6]. The overall objective is to shape demand for zero-emission vehicles, in particular EV.

If the coronavirus pandemic has underlined the strategic importance of transport and the vulnerability of supply lines, the Commission nevertheless explains that "*we must shift the existing paradigm of incremental change to fundamental transformation*". Yet, the road remains long: the Commission admits that the proportion of zero-emission vehicles is still "*far too low today*", especially in regards to the ultimate objective: 30 million zero-emission vehicles on EU roads by 2030, and almost 100% of new cars, vans, buses and heavy-duty vehicles to be zero-emission by 2050[7]. Along with the EU climate commitments, governments have planned to fully phase-out internal combustion engines to foster the uptake of clean vehicles, such as Norway for 2025, the Netherlands in 2030, France, Portugal and Spain for 2040 and 2050 for Germany[8].

With these objectives in mind, today's trend for electrification of vehicles stands at a critical juncture. At the global level, the number of EV on the roads was 17 000 in 2010, 7.2 million in 2019 until reaching an all-time high of 10 million[9] and 16.4 million of units[10] in 2020 and 2021 respectively. EV demand is largely concentrated in the hands of China, Europe and the United States, which respectively gather 4.5 million, 3.2 million and 1.7 million of the 10 million global electric car stock in 2020. The share of new EV registrations on the percentage of total new vehicles registrations reached 10% in Europe in 2020 (4.6% worldwide)[11]. More precisely, EV market share in 2020 increased to 75% in Norway, 32% in Sweden, 13% in the Netherlands, 11% in France, Belgium and the United Kingdom[12]. In 2020, Europe has overtaken China as the world's largest EV market for the first time: while EV registrations accounted for 3 million globally in 2020, Europe heads the list with 1.4 million new registrations, China comes next with 1.2. million, and the United States comes third with 295 000[13].

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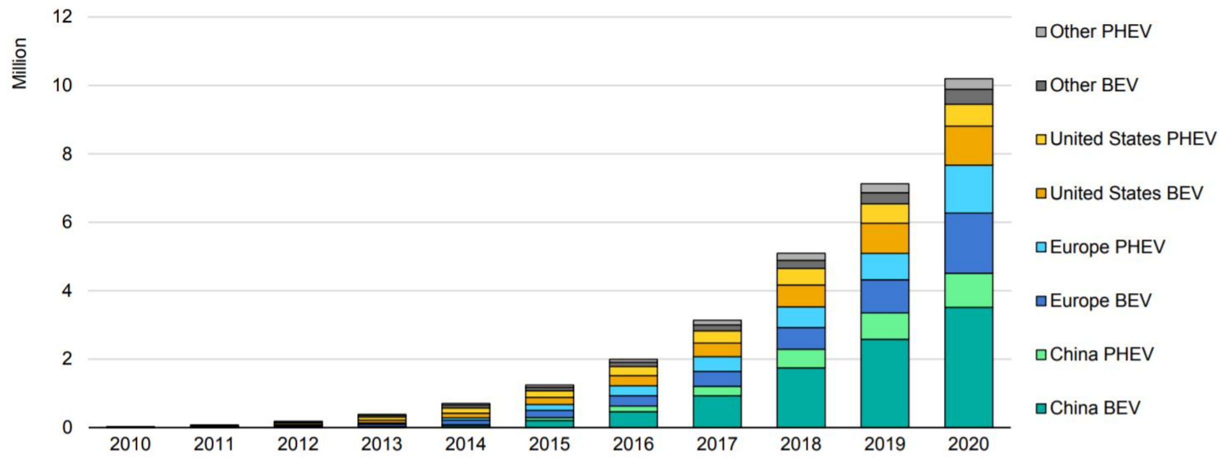
[6] EC, *Make Transport Greener*, fact sheet, July 2021.
[7] EC, *Sustainable and Smart Mobility Strategy – putting European transport on track for the future*, December 9, 2020, p. 1-3.
[8] INTERNATIONAL ENERGY AGENCY [IEA], *Global EV Outlook 2021: Accelerating ambitions despite the pandemic*, 2021, p. 44.
[9] IEA, *Global EV Outlook 2020: Entering the decade of electric drive?*, 2020, p. 40; IEA, *Global EV Outlook 2021* (…), p. 5.
[10] GREENCARS, "How Many Electric Vehicles Sold in 2021?", https://www.greencars.com/post/how-many-electric-vehicles-sold-in-2021, 2021.
[11] IEA, *Global EV Outlook 2020* (…), p. 40; IEA, *Global EV Outlook 2021* (…), p. 5
[12] STATISTA, "Market share of newly registered passenger electric vehicles in selected European countries in 2020, by type", https://www.statista.com/statistics/625795/eu-electric-vehicle-market-share-by-country/, 2022.
[13] IEA, Global EV Outlook 2021, *op.cit.,* p. 19. The figures for 2021 could not be accessed prior to publication.

Figure 1: Global electric car stock, 2010-2020



Reference: International Energy Agency Global EV Outlook 2021[14]

We are therefore witnessing a paradigmatic shift in consumption patterns[15] : 2019 and 2020 were milestone years for sales of electric cars around the world. In the EU, this phenomenon can be explained to some extent by the adoption of public policies that enhance the supply and demand of electric car sales. The publication of a new European regulation has provided an essential impetus to boost supply: on 1 January 2021, the EU regulation setting CO_2 emission performance standards for new passenger cars and for new light commercial vehicles entered into force, compelling car manufacturers to adapt their production according to the EU fleet-wide CO_2 emissions targets – ultimately, supporting the uptake of low or zero emissions vehicles. For the period 2020-2024, the average tailpipe emissions from fleets must fall below 95g CO_2/km[16]. The regulation also requires incentive mechanisms for zero and low emissions vehicles for carmakers in the form of a super-credit system. The substantial surge in the supply of new EV models noticeably illustrates the compliance-driven nature of the European EV market: EV models were available in 2019 as a number of 45 in the EU (279 globally with 171 China)[17] and 100 models in 2020 (370 globally)[18].

[14] Electric vehicle battery are being either used in battery electric vehicle (BEV) or plug in hybrid electric vehicle (PHEV).

[15] BONNET C., COPINSCHI P., HAFNER M., LABOUE P., "L'alliance européenne des batteries : enjeux et perspectives européennes" in *Observatoire de la sécurité des flux et des matières énergétiques*, 2021, p. 11.

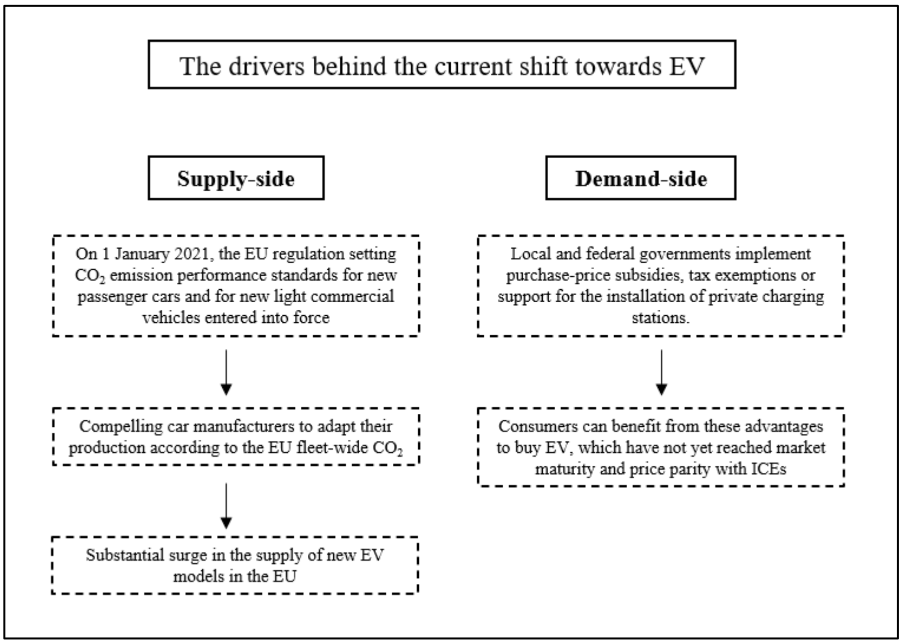
[16] These target levels refer to the NEDC emission test procedure. From 2021 onwards, the emission targets for manufacturers will be based on the new WLTP emission test procedure. Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011 (recast). From 2025-2030, the regulation will compel manufacturers to further pursue their commitments to reducing CO2 emissions by 15% from 2025 on and 37.5% reduction from 2030 on, compared to 2021 levels.

[17] EUROPEAN FEDERATION FOR TRANSPORT AND ENVIRONMENT [TRANSPORT & ENVIRONMENT], *Electric Surge: Carmaker's electric can plans across Europe 2019-2025,* 2019, p. 7 & 13.

[18] IEA, *Global EV Outlook 2021* (…), p. 133. The number of models does not take into account variants of the same model: if a model comes with two different battery ranges, it is considered as only one model.

On the demand side, financial incentives have a significant influence on consumers' behavior. In the EV market, they aim to drive consumers' behavior as EV are still not reaching market maturity and price parity with the 100-year-old internal combustion engines[19]. These financial incentives can include – but usually for a limited time-period – purchase-price subsidies, tax exemptions (such as the abolition or reduction of the registration tax) or support for the installation of private charging stations. Consumer incentives for EV purchases were already implemented by local and federal governments in the EU before the COVID-19 pandemic but the crisis has further spurred public authorities to reinforce EV schemes as part of stimulus packages to mitigate the economic burden of the pandemic[20]. Sales between July and December 2020 exceeded 2019 levels each month in all major markets, despite the second-wave of the outbreak[21]. In Germany for instance, 130 billion post-COVID-19 stimulus packages adopted in June 2020 provide large funds for infrastructure development, tax cuts and other subsidies to boost the German EV market. In this way, the German government has decided to extend its environmental bonus scheme to December 2021, which grants a purchase premium from 3 760€ to 9 000 € based on the initial price of the vehicle and the type of electric vehicle[22].

Figure 2: The drivers behind the current shift towards EV



[19] TRANSPORT & ENVIRONMENT, *Op. Cit.*, p. 12
[20] MCKINSEY & COMPANY, *Electric mobility after the crisis: Why an auto slowdown won't hurt EV demand*, 2020, p. 2
[21] IEA, *Global EV Outlook 2021* (…), p. 45
[22] "The Ultimate Guide to EV Incentives in Germany" in https://blog.wallbox.com/en/the-ultimate-guide-to-ev-incentives-in-germany/.

2. *The EU strategic need of securing raw materials for EV batteries*

As we have just discussed above, to meet the ambitions of carbon neutrality by 2050, the European Union is relying on a number of less polluting technologies in the transport sector, including electric cars. Electric vehicle battery, commonly Li-ion batteries, are being either used in battery electric vehicle or plug-in hybrid electric vehicle. This paradigm shift towards electric vehicles is the driving force behind the recent drastic increase in demand for Li-ion batteries.

These batteries are composed of several raw materials, such as cobalt, copper, natural graphite, silicone, nickel and lithium[23]. Given the strategic importance of batteries for the EU, the latter's strategy for the supply of these materials is pursuing two different but complementary directions which aim to increase the Union's resilience.

Firstly, the EU declares its readiness to accelerate its transition towards a regenerative growth model that breaks with the extractivism inherited from past decades. Indeed, between 1970 and 2010, world extraction increased from 27 to 92 billion tons[24]. Reversing this trend is a significant issue facing the Union: it is estimated that human needs in resources contribute to half the production of greenhouses gases and 90% of the world's biodiversity losses and water supply problems today[25]. Pursuing similar guidelines for battery composition, the Union intends to strengthen its requirements for recycled materials in batteries. As from 1 January 2017, the proportion of recycled raw materials (cobalt, lead, lithium and nickel) contained in the batteries of electric cars has to be clearly indicated[26] while from 2030 on, mandatory minimum levels of recycled contents will be fixed in the composition of batteries (12% of cobalt, 85% of lead, 4% of lithium and 4% of nickel)[27]. In this respect, several actions are already underway and the European Investment Bank is supporting a wide range of projects to achieve this goal[28].

Secondly, the attention brought on the supply of raw materials is deeply colored by a geopolitical and strategic dimension. Thus, EV batteries raw materials are qualified as "critical" according to two criteria: economic importance and risk of shortage. In a very prosaic way, as these materials and their deposits are limited, what another state holds represents a potential risk for the EU. The objective of such strategic vision is therefore to avoid replacing a dependency – on fossil fuels – with

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[23] EC, *Commission Staff working document. Report on Raw Materials for Battery Applications*, November 22, 2018, p. 2 ; BONNET C., COPINSCHI P., HAFNER M., LABOUE P., *Art. cit.*, p. 8 ; LEBEDEVA N., DI PERSIO F. & BOON-BRETT L., *JRC Science for policy report. Lithium ion battery value chain and related opportunities for Europe*, 2017, p. 9-12.

[24] NICKLAUS D. & VIEL D., "La consommation durable des ressources naturelles : un enjeu planétaire" in *Annales des Mines – Responsabilité et environnement*, n°99, vol. 3, 2020, p. 80.

[25] EC, *The European Green Deal* (…), p. 7.

[26] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020.

[27] Read "Europe: EU Commission proposes new regulation for sustainable batteries", https://www.globalcompliancenews.com/2021/04/05/all-europeeu-commission-proposes-new-regulation-for-sustainable-batteries110321/, 2021.

[28] Read COZIGOU G., "La stratégie européenne dans le domaine des matières premières" dans *Annales des Mines – Responsabilité et environnement*, n°99, 2020, p. 90-91.

another – on critical materials[29]. As a sign of the growing strategic importance of these materials, the list of critical raw materials proposed by the EU every three years since 2011 keeps growing: from 14 in 2011, 20 in 2014, 27 in 2017, it now includes 30 materials. More accurately, when it comes to battery raw materials, cobalt and graphite have been on this list since the beginning, while lithium was only added in 2020 and copper, nickel and silicon are not yet included.

However, the expected and desired growth in the use of EV and thus of their batteries will more than likely exacerbate the criticality of the raw materials previously identified. Consequently, if the Union wishes to electrify its means of transport, it must acquire new sources of supply. For example, according to the Commission, if the EU is to meet its 2050 climate neutrality target, it will 'simply' need to acquire almost 20 times more lithium and 5 times more cobalt by 2030, and respectively 60 and 15 times more by 2050 (all sectors considered)[30]. Failure to meet these targets would trigger supply problems for the Union[31]. Yet, the Union's current supply lines are "potentially vulnerable to disruption" according to the Commission[32]. Several strategic players have already started to secure their supply chains, for example carmakers such as Tesla[33] and countries such as China[34]. This is all the more urgent as the price of these materials is rising, thereby increasing the cost of some EVs[35]. Demand for battery raw materials is increasing globally and it is estimated that it will increase by 1000% worldwide by 2050[36].

Although the supply of raw materials for batteries is globally sourced (the EU has trade and free agreements with the Democratic Republic of Congo, Russia, Chile or Brazil[37]), the EU is not deprived of raw material sources. Indeed, significant traces of cobalt (Finland, France, Sweden, Slovakia), lithium (Austria, Czech Republic, Finland, Ireland, Portugal, Spain, Sweden), graphite (Austria, Czech Republic, Germany, Slovakia, Sweden) and nickel (Austria, Finland, France, Greece, Poland, Spain) can be found throughout Europe[38].

However, the mineral potential of the Union, especially from its maritime space, remains under-exploited, primarily because of the lack of accurate geological data; the weakness of integration of the mining sector and of the land use planning; the diversity of European regulations; and the lack of public information on this subject[39]. In the meantime, the EU's current dependence on China is

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[29] EC, *Résilience des matières premières critiques : la voie à suivre pour un renforcement de la sécurité et de la durabilité*, Septembre 3, 2020, p. 1.

[30] ALVES DIAS, P. et al., *JRC Science for policy report. Cobalt: demand-supply balances in the transition to electric mobility,* 2018.

[31] EC, *Résilience des matières premières critiques* (…), p. 6.

[32] EC, *Commission Staff working document* (…), p. 2.

[33] TESLA, "Tesla Conflict Minerals Report", https://www.tesla.com/sites/default/files/about/legal/2018-conflict-minerals-report.pdf, 2018.

[34] BONNET C., COPINSCHI P, HAFNER M, LABOUE P., *Art. cit.*, p. 8.

[35] Read for example ISIDORE C., "Elon Musk blames rising Tesla prices on raw material costs" in *CNN Business*, June 1, 2021.

[36] EC, *Résilience des matières premières critiques* (…), p. 6.

[37] EC, *Commission Staff working document* (…), p. 3.

[38] Read for example DEHAINE, Q. & AL., "Battery minerals from Finland: improving the supply chain for the EU battery industry using a geometallurgical approach" in *European Geologist*, n°49, May 2020, p. 5-11.

[39] EC, *Europe on the Move*. (…), p. 3-6 ; DE CARVALHO, A., "L'initiative européenne sur les matières premières" in *Annales des mines – Responsabilité et environnement,* n°58, 2010, p. 76 ; DANINO-PERRAUD R., "La mine urbaine, une ressource stratégique pour l'Union européenne ?" in *Revue internationale et stratégique*, 2019, n°113, p. 199-200.

worrying. Beijing is at the heart of raw material refining, with 80% of the world's battery materials processing capacity located on Chinese soil while 23% of the world's production of critical minerals is said to be Chinese. Plus, China has already begun to secure its supply lines, buying up to 8 of the 14 cobalt mines in the Democratic Republic of Congo. Beijing also accounts for 80% of world imports of nickel, 77% of cobalt and 69% of manganese[40] and represents 39% of world consumption of lithium[41]. The Popular Republic has become the main supplier of so-called critical materials[42] and the EU is, in short, almost entirely dependent on foreign powers for its supply of raw materials[43]. Yet, some argue the EU's dependence on raw materials is still less significant than its dependence on oil[44].

The European Commission writes that "*as if this challenge were not enough, the COVID-19 pandemic crisis has revealed how quickly and deeply global supply chains can be disrupted*"[45]. This is all the more significant for the automobile industry, which plays a key economic role in Europe[46]. What are the solutions to this challenge facing the Union? Gildas Bureau gives insight into a very simple but pragmatic mantra. According to him, "*a realistic orientation is not to have independence on all strategic materials, but rather to systematically reduce this dependence*"[47]. Six mechanisms would make this possible: substitution of materials (when and if possible), diversification (through agreements with other countries such as Malaysia or Australia, or by using EU resources) and securisation (through diplomacy, industrial agreements) of supply lines, circular economy, economical intelligence and R&D (through innovative solutions)[48].

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[40] BONNET C., COPINSCHI P, HAFNER M, LABOUE P., *Art. cit.*, p. 45-46.
[41] "China's heavy reliance on lithium from Australia may ease with rising domestic supplies" in *Global Times*, July 18, 2021.
[42] BUREAU G., "Matières premières, criticités et axes stratégiques dans les industries de l'automobile" in *Annales des Mines – Responsabilité et environnement*, n°99, 2020, p. 61.
[43] COZIGOU G., *Art. cit.*, p. 89.
[44] Read MATHIEU L., "Les batteries de voiture électriques nécessitent moins de matières premières que les voitures thermiques – étude" in *Transport & Environment*, https://www.transportenvironment.org/press/les-batteries-de-voitures-%C3%A9lectriques-n%C3%A9cessitent-beaucoup-moins-de-mati%C3%A8res-premi%C3%A8res-que-les, March 1, 2021.
[45] EC, *Résilience des matières premières critiques* (…), p. 2.
Authors' translation.
[46] EDDY J., PFEIFFER A. & VAN DE STAAIJ J., "Recharging economies: The EV-battery manufacturing outlook for Europe", McKinsey & Company, May 2019, p. 4.
[47] BUREAU G., *Art. cit.*, p. 65.
Authors' translation.
[48] *Ibid* ; COZIGOU G., *Art. cit.*, p. 92 ; FRANCESCO DE LOTTO F., "Pietro Francesco De Lotto : 'Sans résilience des matières premières critiques, la révolution industrielle verte ou numérique n'aura pas lieu'", July 29, 2021, https://www.touteleurope.eu/environnement/pietro-francesco-de-lotto-sans-resilience-des-matieres-premieres-critiques-la-revolution-industrielle-verte-ou-numerique-n-aura-pas-lieu/

3. *Large-scale factories in the EU, a chance to curb dependence on Asia?*

Although it cannot yet effectively lower its dependence upon foreign raw materials, the EU intends to focus on the industrialization of the continent in the production of efficient, qualitative and green batteries. This development is a strategic imperative towards the green transition and the automotive competitiveness[49]. The European Battery Alliance launched by the European Commission in 2017 aims at reaching this goal: developing an innovative, competitive and sustainable battery value chain in Europe, putting forward "*the EU as a global leader in sustainable battery production and use*". More precisely, the alliance intends to promote European and sustainable battery cell production and investments[50]. In this regard, funding such as grants and preferential loans have been allocated to European and non-European battery cell manufacturers to support them either to build their activities or expand their production[51].

So as to better understand the dynamics of EU battery cell production, we need to dive into the battery production process. It can be divided in 3 stages: cell manufacturing, module manufacturing and pack assembly. Some manufacturers produce all three in a single location, while others tend to split the chain between two or three places[52]. The first step, battery cell manufacturing, is today the Union's leading strategic focus. As a consequence, large-scale battery production known as battery Giga factories are key strategic elements to securitise and support all segments of the battery value chain within the EU. Accordingly, significant investments have been made to boost cell production capacity in Europe in recent years. Still, the road ahead is long: in 2019, 80% of the world's battery cell production occurred in China, Korea and Japan, Beijing being by itself responsible for 73% of this production. Furthermore, Chinese industry produced 83% of the world's anodes and 61% of the world's manufactured cathodes[53]. In 2019, out of the 115 lithium battery Giga Factory construction projects identified worldwide, 88 were based in China[54].

Consequently, European car producers and battery manufacturers are joining forces, forming strong alliances with the objective to build European Giga factories for cell production. Since the creation of the European Battery Alliance, the number of Giga factories announced has been on the rise. The alliance announced that battery cell factories within the EU is expected to reach a production capacity of 200GWh by 2025 and of 500GWh by 2030, compared to 26 GWh by the end of 2020. Current forecast plan production of battery cells worldwide is expected to spur global production

[49] EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM FOR BATTERIES, *Batteries Europe: Strategic Research Agenda for batteries 2020*, 2020, p. 16.

[50] "European Battery Alliance" in https://ec.europa.eu/growth/industry/policy/european-battery-alliance_en.

[51] MATHIEU C., "Green Batteries: A competitive advantage for Europe's Electric Vehicle Value Chain?", *Etude de l'IFRI*, IFRI, April 2021, p. 10

[52] COFFIN D. & HOROWITZ J., "The Supply Chain for Electric Vehicles Batteries" in *Journal of International Commerce and Economics*, December 2018, p. 5

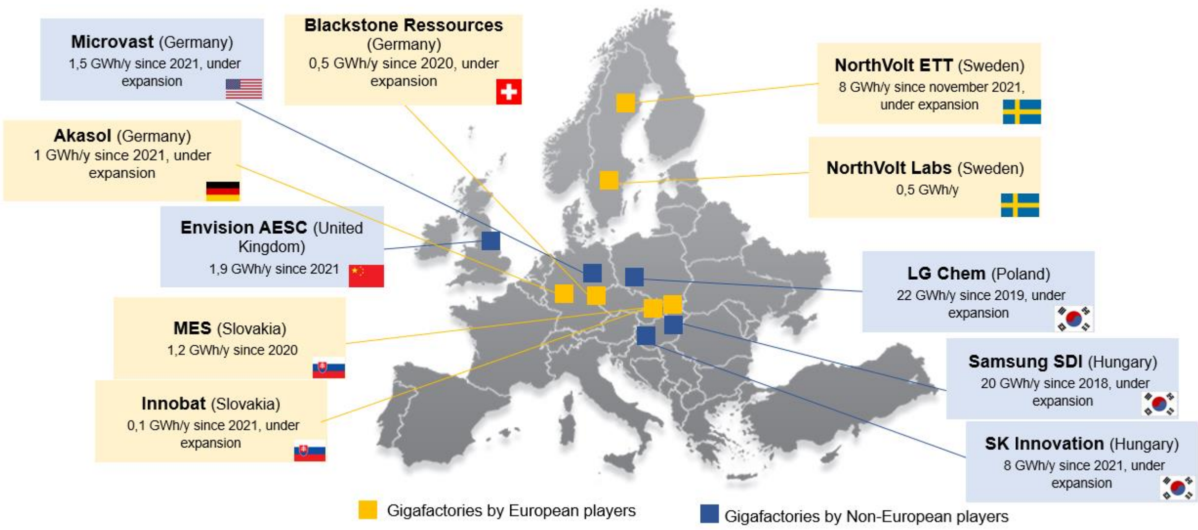
53 Battery are made up of individual cells that are connected altogether. Each individual cell is composed of three components, a positive electrode, a negative cathode, and a thin layer of electronic insulation imbibed in electrolyte53 (ion-conducting liquid medium) that sets the two electrodes apart (lithium goes from the cathode to the anode through the separator when charging while it goes the other way around while on discharge). BONNET C., COPINSCHI P, HAFNER M, LABOUE P., *Art. cit.*, p. 47.

[54] *Ibid.*, p. 47-48.

capacity, increasing by a factor of 2.5-4, largely driven by Europe[55]. Current trends place Europe as the second largest battery producer in the world by 2030[56].

Nevertheless, among the many announcements of factory construction within the EU, we mostly find non-European players, either in the process of setting up a presence or expanding their production lines in Europe, alongside newly-created European start-ups. For instance, the battery cells for Renault's ZOE, Volkswagen ID.3 and Audi e-tron are all being produced by LG Chem (South Korean manufacturer) in Poland[57]. Reversing this trend to incentivize the setting-up of European players has been and remains a major challenge facing the European Commission. Hence funds for projects of common European interest for battery cell production have been mobilized. In 2021, 11 Giga factories[58] were operational in the EU and the capacity production was largely dominated by Korean players (see figure 3).

Figure 3: Operating battery giga factories in the EU in 2021 (UK included)



Source: Monitoring conducted by the authors, based on firm announcements in the press

Given current forecasts, we can expect new European players of battery cell manufacturing to be established by the end of the decade: the French ACC and Verkor, the Swedish Northvolt that should further expand, the Norwegian Freyr, etc. (See figure 4). These will be joined by other non-European players and European carmakers themselves.

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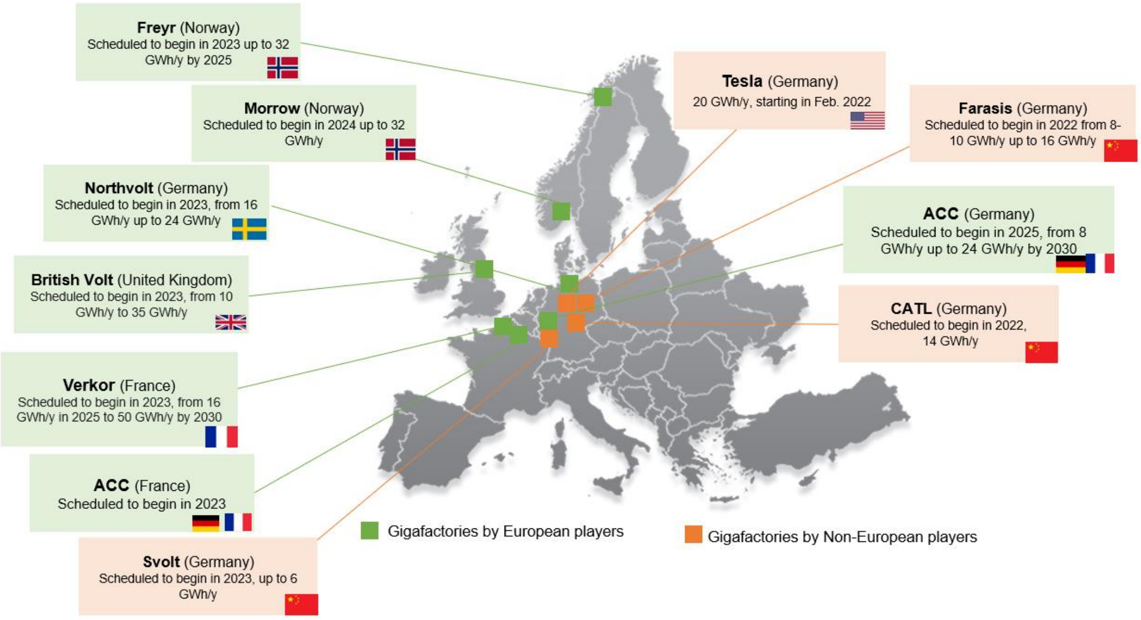
55 European Technology and Innovation Platform for Batteries, *op. cit.,* p. 12-13 ; EY Parthenon, "Why the race is on to secure a sustainable EV battery supply", June 28, 2021; https://www.ey.com/en_gl/strategy/why-the-race-is-on-to-secure-a-sustainable-ev-battery-supply ; TRANSPORT & ENVIRONNEMENT, *op.cit*., p. 24.

56 BONNET C., COPINSCHI P, HAFNER M, LABOUE P., *Art. cit.*, p. 47-48

57 MATHIEU C., *Art. Cit.*, p. 12-14

58 According to the authors' monitoring of company announcements and based on capacity cell production in GWh per year.

Figure 4: Planned giga factories in the EU (UK and Norway included)



Source: Monitoring conducted by the authors, based on firm announcements in the press

In the meantime, European carmakers are currently working on securing their battery cell production through strategic partnerships with cell manufacturers[59] or strategic investments in building their own Giga factories. The BMW Group's multi-supplier strategy with CATL (Chinese), Samsung SDI, NorthVolt (Swedish) and Eve Energy (Chinese)[60] illustrates this securitization of battery cell production. In addition, the Group "*is planning a pilot plant for the production of battery cells for electric cars near Munich*"[61]. In the same vein, Tesla has planned to build battery cell and battery packs in Germany where its Models Y crossover and 3 sedan will be constructed[62].

Alongside these races to produce batteries in the EU, the European Commission proposed in December 2020 a new Battery regulation that will enter into force in 2022, ensuring that EV and other batteries placed in the EU market are sustainable and safe throughout their life cycle. In addition to the recycled raw materials requirement cited above, the entire supply chain will have to become more sustainable and transparent. The new battery regulation will require the establishment of chains of control, traceability and the identification of materials and actors concerned. In addition, from July 2024, EV battery manufacturers will be compelled to provide a carbon footprint declaration that must include details of the geographic location of the battery manufacturing facilities, the total carbon footprint (also differentiated by life cycle stage) and thereafter, compliance with a maximum threshold for the declared carbon footprint value (from July

[59] Cathode active materials, synthetic graphite and other key materials producers.
[60] EY Parthenon, *Art. Cit.*.
[61] "BMW apparently planning a pilot battery plant" in *electrive.com*, https://www.electrive.com/2020/07/01/bmw-apparently-planning-a-pilot-battery-plant/, July 1, 2020.
[62] "Tesla plans battery cell production at Berlin factory" in *Automative News Europe*, https://europe.autonews.com/automakers/tesla-plans-battery-cell-production-berlin-factory, September 25, 2020.

2027)[63]. This new regulation aims to make sure that the large-scale deployment of EV is consistent with the EU's ambition of climate neutrality and sustainable use of resources whilst providing green European new entrants with greater prospects to challenge Asian players[64]. It now remains to be seen if it will be the case…

Conclusion

This article aimed at providing an overview of the current shift towards EV and the dynamics related to the development of fleet electrification, such as the dependence on the sourcing of raw materials to manufacture these batteries but also the lack of production plants on the continent. Other concerns have been identified. In the light of the climate emergency, we are watching a shift in consumption towards electrification, rather than a reduction in the production and use of cars. This consumption of EV batteries is compelling Europe to turn to new supply sources, increasing its dependence on foreign countries and which raises doubts about the real "green" character of these newly attractive raw materials. Europe has begun manufacturing on its territory, but there is still a long way to go, especially as the vast majority of the factories that would be able to bring about a change in the situation have not yet been built.

The question that may arise at this point is, when the European industry is further advanced in the production of battery cells, will it remain so heavily dependent for the steps that occur prior to the production of battery cells? In its new regulation, the Commission proposes to set a specific quota for selected materials to be recycled. Is the European recycling industry ready for this? Today, only a few EU players, such as NorthVolt for instance, have the intention to fully integrate the circular economy and clean energy as cores in their production, but will they become the norm, and if so, how?

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[63] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020.

[64] MATHIEU C., *Art. Cit.*, p. 3.

References

Official papers

EUROPEAN COMMISSION, *Europe on the Move. Sustainable Mobility for Europe: safe, connected and clean,* May 17, 2018, *Annex 2: Strategic Action Plan on Batteries*.

EUROPEAN COMMISSION, *Résilience des matières premières critiques : la voie à suivre pour un renforcement de la sécurité et de la durabilité*, Septembre 3, 2020.

EUROPEAN COMMISSION, *Sustainable and Smart Mobility Strategy – putting European transport on track for the future*, December 9, 2020.

INTERNATIONAL ENERGY AGENCY [IEA]*, Global EV Outlook 2021: Accelerating ambitions despite the pandemic*, 2021.

INTERNATIONAL ENERGY AGENCY, *Global EV Outlook 2020: Entering the decade of electric drive?*, 2020.

EUROPEAN FEDERATION FOR TRANSPORT AND ENVIRONMENT*, Electric Surge: Carmaker's electric can plans across Europe 2019-2025,* 2019.

EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM FOR BATTERIES, *Batteries Europe: Strategic Research Agenda for batteries 2020*, 2020

EUROPEAN COMMISSION, *Make Transport Greener*, fact sheet, July 2021.

EUROPEAN COMMISSION, *The European Green Deal*, December 11, 2019.

Scientific Articles

BONNET C., COPINSCHI P., HAFNER M., LABOUE P., "L'alliance européenne des batteries : enjeux et perspectives européennes" in *Observatoire de la sécurité des flux et des matières énergétiques*, 2021.

BUREAU G., "Matières premières, criticités et axes stratégiques dans les industries de l'automobile" in *Annales des Mines – Responsabilité et environnement*, n°99, 2020, p. 60-73.

COFFIN D. & HOROWITZ J., "The Supply Chain for Electric Vehicles Batteries" in *Journal of International Commerce and Economics*, December 2018.

COZIGOU G., "La stratégie européenne dans le domaine des matières premières" dans *Annales des Mines – Responsabilité et environnement*, n°99, 2020, p. 24-28.

DANINO-PERRAUD R., “La mine urbaine, une ressource stratégique pour l’Union européenne ?” in *Revue internationale et stratégique*, 2019, n°113, p. 199-208.

DE CARVALHO, A., “L’initiative européenne sur les matières premières” in *Annales des mines – Responsabilité et environnement,* n°58, 2010, p. 75-78.

DEHAINE, Q. & AL., “Battery minerals from Finland: improving the supply chain for the EU battery industry using a geometallurgical approach” in *European Geologist*, n°49, May 2020, p. 5-11.

MATHIEU C., “Green Batteries: A competitive advantage for Europe’s Electric Vehicle Value Chain?”, *Etude de l’IFRI*, IFRI, April 2021.

NICKLAUS D. & VIEL D., “La consommation durable des ressources naturelles : un enjeu planétaire” in *Annales des Mines – Responsabilité et environnement*, n°99, vol. 3, 2020, p. 80-83.

SMITH K., “Beyond the civilian power EU debate” dans *Politique européenne*, n°17, vol. 3, 2005, p. 63-82.

Working papers

ALVES DIAS, P. et al., *JRC Science for policy report. Cobalt: demand-supply balances in the transition to electric mobility,* 2018.

EDDY J., PFEIFFER A. & VAN DE STAAIJ J., “Recharging economies: The EV-battery manufacturing outlook for Europe”, McKinsey & Company, May 2019.

EUROPEAN COMMISSION, *Commission Staff working document. Report on Raw Materials for Battery Applications*, November 22, 2018.

LEBEDEVA N., DI PERSIO F. & BOON-BRETT L., *JRC Science for policy report. Lithium ion battery value chain and related opportunities for Europe*, 2017.

MCKINSEY & COMPANY, *Electric mobility after the crisis: Why an auto slowdown won’t hurt EV demand*, 2020.

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020.

Web resources

"BMW apparently planning a pilot battery plant" in *electrive.com*, https://www.electrive.com/2020/07/01/bmw-apparently-planning-a-pilot-battery-plant/, July 1, 2020.

"China's heavy reliance on lithium from Australia may ease with rising domestic supplies" in *Global Times*, July 18, 2021.

"Europe: EU Commission proposes new regulation for sustainable batteries", https://www.globalcompliancenews.com/2021/04/05/all-europeeu-commission-proposes-new-regulation-for-sustainable-batteries110321/, 2021.

"European Battery Alliance" in https://ec.europa.eu/growth/industry/policy/european-battery-alliance_en.

"Tesla plans battery cell production at Berlin factory" in *Automative News Europe*, https://europe.autonews.com/automakers/tesla-plans-battery-cell-production-berlin-factory, September 25, 2020.

"The Ultimate Guide to EV Incentives in Germany" in https://blog.wallbox.com/en/the-ultimate-guide-to-ev-incentives-in-germany/.

"Why the race is on to secure a sustainable EV battery supply", https://www.ey.com/en_gl/strategy/why-the-race-is-on-to-secure-a-sustainable-ev-battery-supply, June 28, 2021.

GREENCARS, "How Many Electric Vehicles Sold in 2021?", https://www.greencars.com/post/how-many-electric-vehicles-sold-in-2021, 2021.

ISIDORE C., "Elon Musk blames rising Tesla prices on raw material costs" in *CNN Business*, June 1, 2021.

MATHIEU L., "Les batteries de voiture électriques nécessitent moins de matières premières que les voitures thermiques – étude" in *Transport & Environment*, https://www.transportenvironment.org/press/les-batteries-de-voitures-%C3%A9lectriques-n%C3%A9cessitent-beaucoup-moins-de-mati%C3%A8res-premi%C3%A8res-que-les, March 1, 2021.

STATISTA, "Market share of newly registered passenger electric vehicles in selected European countries in 2020, by type", https://www.statista.com/statistics/625795/eu-electric-vehicle-market-share-by-country/, 2022.

TESLA, "Tesla Conflict Minerals Report", https://www.tesla.com/sites/default/files/about/legal/2018-conflict-minerals-report.pdf, 2018.

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