COFACE ECONOMIC PUBLICATIONS

27 JULY 2021

FOCUS

By Khalid Aït-Yahia,
Senior Economist & Statistician
based in Paris, France

Will the electric vehicle metals boom last?

Executive summary

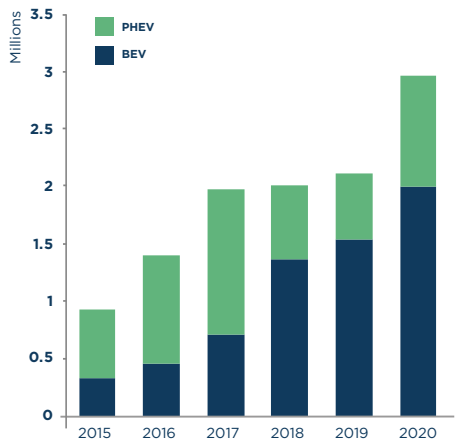
Metals used in electric vehicles (EV, PHEV[1] or BEV[2]), mainly lithium, cobalt and copper, are highly demanded as they are at the forefront of a revolution in the automotive industry. Stringent regulations, States' support schemes, and customers' willingness to buy and own EV are bolstering demand for these vehicles. However, imbalances between supply and demand are pushing prices higher, while EV market shares have not overtaken that of traditional engines. Therefore, we do not expect major downside risks on prices for the two coming years (when compared to 2020 levels). Market imbalances between supply and demand cannot be erased overnight, as investments in additional capacity or better resource management require years to come online. As prices rise, we expect different battery configurations or the use of hydrogen as an energy source to put more pressure on the use of metals such as cobalt or lithium. Costly integration of these materials helps drive research & development, therefore the adoption of other materials and technologies, such as batteries without cobalt. Moreover, the current momentum in alternative battery configuration and hydrogen adoption may be a game changer for the industry as many countries are rushing to develop industries, and thus products, in order to take a lead on the short (2 years) to medium-term (up to ten years) on the next generation vehicles.

Cobalt, lithium, and copper are key in EV batteries

a. Digging into EV batteries: what kind of metals is needed ?

The electric vehicle (EV) segment is gaining momentum globally, with a 13% market share in 2020 (vs. 8% in 2019). According to the International Energy Agency (IEA[3]), while car sales declined by 6%, EV sales increased by 41% in 2020, as Europe showed a strong appetite for this segment. During the first quarter of 2021, EV sales surged by 41% compared with Q1 2020 and are expected to rise by 70 % this year[4].

CHART 1
Global EV sales evolution, in millions of units



Source: IEA, Coface

1 - Plug in hybrid electric vehicles.
2 - Battery electric vehicles.
3 - Global EV Outlook 2021 : Accelerating ambitions despite the pandemic.
4 - https://ihsmarkit.com/research-analysis/ihs-markit-forecasts-global-ev-sales-to-rise-by-70-percent.html

coface FOR TRADE

EV sales will continue to grow in the coming years, as stringent regulations affecting particles emissions, public subsidies and development of new models will push both households and fleets to buy these cars. According to Bloomberg New Energy Finance (BNEF), EV global shares in total vehicles in 2025, 2030 and 2040 will reach 10%, 28% and 58% respectively, from 2.7% in 2020[5]. Furthermore, internal combustion engines (ICE, petrol and diesel) will be banned in many markets, notably in Europe by 2035, which will remove competition for electric engines. Indeed, the Green deal proposed by the President of the European Commission, Ursula von der Leyen, aims to reduce carbon emissions by 55% by 2030, through many levers: expanding and reinforcing the Emissions Trading Scheme (ETS) by increasing the price of polluting, establishing a levy on goods imported from countries with lax environmental regulations, imposing additional taxes on airlines, etc.

This trend is putting pressure on metals needed by carmakers to produce electric vehicles, such as lithium, cobalt, graphite, nickel, rare earth elements and copper. Lithium and graphite are considered to greatly benefit from the EV take-off. A typical battery for an EV includes dozens of kilograms of metals, if not hundreds, the first being aluminium, which accounts for around half of total weight, followed by copper, graphite and nickel. However, the electric vehicles segment has various categories, depending on the kind of battery and the vehicle size. Battery Electric Vehicles (BEV) are those for which the electricity to power the engine is stocked in a battery, while Plug-in Hybrid Electric Vehicles (PHEV) have two engines: one ICE and one electric. The battery that powers the electric engine needs a charging station, which is not the case for hybrid vehicles sold by Toyota. Not only do these differences influence the weight of each metal included in the battery, but also the size of the car. A bigger car needs a bigger battery, hence a higher quantity of metals.

Aluminium is included into batteries, but also serves in the chassis, internal panels, shock tower, etc. This alloy is favoured due to its weight and the crash protection it gives to passengers. Being lighter helps cars to increase their range, as it enables a lower consumption of electricity. Moreover, this will put steel in second position even though it is cheaper than aluminium. Compared with an ICE car, a typical electric vehicle requires an extra 30% aluminium, which bodes well for this industry and new entrants, notably in the segment of battery housing, which is a piece of metal protecting the battery. Like aluminium, the case of copper is interesting because it is needed as a core and key raw material, but grids (companies providing electricity) will have to invest and develop their networks to be on par with higher demand. Copper is used in every component of an electric vehicle. This ubiquity helps this metal by increasing its weight. According to Wood McKenzie, a fully electric bus needs between 11 and 16 times more copper than an ICE[6] bus. According to a 2020 EY report[7], in a scenario where 100% of all vehicles sold are electric, nickel and cobalt demand will rise by 20-fold compared with current consumption, which will not only put pressure on miners, but also on carmakers and their suppliers as sourcing will definitely be a headache.

b. Inadequacy between supply and demand: demand growth is expected to continue outpacing that of supply in the near-term.

We forecast nickel, aluminium and copper prices to increase by 34%, 25% and 47% between 2020 and 2021, respectively. Furthermore, demand[8] is expected to surge tremendously between 2020 and 2050 (**Table 1**). For instance, EV-related demand for copper will grow by 9.9% each year during this period, while nickel will post a yearly growth rate of 11.8%. Democratic Republic of Congo, Australia, Indonesia, Chile, and Russia are the world's largest producers of these highly demanded metals, should push public authorities in these countries to modify the mining code in order to capture a larger share of generated added value, but also enhance environmental regulations to protect local communities.

The pressure on mining and metalworking companies, to improve supply and cope with such a trend, will be intense. These companies will have to spend large amounts in capital expenditure, while having to deliver strong returns to their shareholders. Indeed, during the last Supercycle[10], mining and metalworking companies invested to acquire mines and build plants in order to match supply with demand. The latter collapsed from 2015 onwards and metals companies suffered from market imbalances, with prices moving on a negative trend. Cash flow generation was difficult and investors asked companies' executives to keep capital expenditure low in order to generate better returns (**Chart 2**).

We can expect capital spending to rise as profitability is increasing. While not being near the upper bound,

TABLE 1
2020-2050 yearly demand growth rate (CAGR) for selected metals used in EV

Metal	CAGR
Lithium	10.1%
Nickel	11.8%
Cobalt	10.0%
Manganese	10.2%
Aluminium	9.7%
Copper	9.9%
Graphite	9.3%
Silicon	17.2%

Source: Nature[9], Coface

CHART 2
Global metal industry capex and net margin evolution

Source: Refinitiv Worldscope, Coface

5 - https://about.bnef.com/electric-vehicle-outlook/
6 - https://www.woodmac.com/news/opinion/copper-powering-up-the-electric-vehicle/
7 - https://www.ey.com/en_gl/mining-metals/how-advancing-mobility-will-disrupt-the-mining-and-metals-sector
8 - https://www.nature.com/articles/s43246-020-00095-x
9 - Ibid.
10 - A period (2000-2014) of rising commodity prices caused by demand coming from emerging countries notably China.

the Pearson correlation coefficient stands at 0.6, which indicates that these two financial metrics move in the same direction[11]. Another factor we greatly favour is the prospect of increasing demand, as described above. With such forecasts, companies evolving in this sector will show a strong appetite to invest in order to increase their income and revenue. Indeed, this sector was deeply impacted by the onset of the pandemic in Q1 2020, with prices falling because demand was knocked out by lockdowns and stay-at-home orders globally. As such, with weaker economic prospects, budgets for exploration and capacity addition were lowered. However, such winds of change should bring an increase in capital spending. The key question here is: are we heading towards a frenzy of exploration, drilling and budget explosion in the forthcoming years? The first hint the industry is giving is that, right now, companies are much more focused into securing financing for low risk projects[12]. Generally, these projects are thought as advanced ones, for which levels for metals are already known (with a margin of error). We think that this will not be enough to match demand, notably in key areas of the EV frenzy. Customers could push metals companies to adopt a more risk-seeking approach to answer these structural changes, while governments will have to act alike to secure the whole supply chain. Therefore, governments are offering incentives to companies to engage in grassroots projects, in order to lower the risk for metals companies[13].

According to a survey made in April by JPMorgan, mining companies will increase their capex by 15% year-on-year in 2021. Metals will be one of the leading sectors (behind pulp and paper, and automotive) in terms of budget increase. Asian and European companies will spend around 50% of the total invested in 2021. The survey informs that budgets could see negative growth rates (on a yearly basis) in 2022 and 2023, but these forecasts could be revised. We think that capex will post positive growth rates in the years ahead as the EV bonanza will push metalworking companies in a race to secure sourcing of key metals. While future growth rates could be below 15%, they should stay positive nonetheless as the imbalances in the market between supply and demand will be strengthened if Greenfield projects are not developed.

Challenges Remain

a. Rival technologies could unsettle cobalt dominance

Key raw materials for batteries are expensive, making it account for one third of vehicle price. Another important factor to consider is the battery's weight (several hundreds of kilos). Although battery prices are quickly decreasing thanks to advancements in research and development (resulting in efficiency gains), they still make EV expensive without subsidies. There is no parity with ICE currently, but BNEF expects prices to be on par with ICE before 2030 (**Chart 3**).

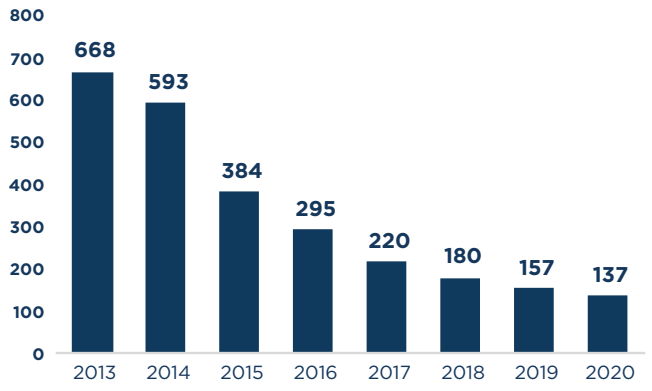
In lithium-ion batteries, the most common for EV, one can find cobalt, manganese, lithium, graphite and other materials, which are purified. Cobalt, for instance, enables safe driving. However, cobalt is an expensive (compared to nickel, whose price is half-cheaper) but necessary product, as it is less prone to start a fire while driving. Therefore, battery makers, a business dominated by Asian companies, are pushing to enhance the efficiency of "traditional" batteries but also to develop new types, for example cobalt-free or with another configuration, to lower the cost. The current battery configuration, known as lithium-ion, includes an electrolyte, a highly inflammable liquid that enables the passage of lithium ions between anode and cathode[14-15], a phenomenon that helps generating electricity. Actors in the battery ecosystem are trying to develop alternatives in order to produce safer and cheaper batteries, of lower weight, meaning additional range[16]. The latter is a criteria highly sought after by customers before the purchase.

A lot of research (and attempts) is done to avoid the use of cobalt in battery cells. Panasonic, the Japanese giant battery maker and Tesla supplier, developed a battery without cobalt for the Model 3 in 2017. However, battery producers and carmakers are also considering alternatives with different configurations. As such, Volkswagen is entering the field by privileging lithium-iron-phosphate (LFP) instead of the expensive cobalt and nickel. This will enable an estimated 50% price cut for entry-level car models. As mentioned above, demand will shift from nonferrous metals to iron ore and phosphate (a mineral used in the fertilizer industry)[16].

The most advanced alternative outside of the lithium-ion area is the solid-state battery, where the liquid electrolyte is no longer needed and is replaced by an electrolyte made of solid material. This battery is thought to offer better safety while being smaller and with a longer lifespan[17]. Major carmakers, such as BMW and Toyota, are entering this field. This alternative uses materials that are abundant, less toxic and cheaper than those deployed currently.

Battery makers and their customers are trying to reduce the reliance of this industry on cobalt, but also to find an alternative source of energy. Hydrogen is generally cited as a strong alternative, able to alleviate all the costs incurred by equipment makers and the burden on the environment. It has the advantage of being environment-friendly, as hydrogen is almost ubiquitous and non-pollutant. However, for mass-market cars and the premium segment, this technology is simply not efficient enough compared to the ICE and EV[18]. Furthermore, the technology needs additional years of research and development to be mature enough, but only for trucks, and will be in a deep competition with batteries, whose characteristics were detailed above. We do not expect hydrogen to be a game-changer in this decade without strong incentives from public authorities. Additionally, players in the battery ecosystem, which includes end-users such as carmakers, will not be incited to favour hydrogen in the near-term as they invested heavily, under the coercive action of authorities, in batteries and their chemistry to comply with stringent regulations.

CHART 3
Global battery prices, in USD per unit



Source; BNEF, Coface

11 - Deeper analysis could confirm that the correlation is not linear.
12 - World Exploration Trends 2021, S&P Market Intelligence, March 2021.
13 - Ibid.
14 - https://www.ft.com/content/c4e075b8-7289-4756-9bfe-60bf50f0cf66
15 - https://letstalkscience.ca/educational-resources/stem-in-context/how-does-a-lithium-ion-battery-work?_ga=2.252788425.1397733863.1620647743-1304268729.1620647743
16 - https://www.reuters.com/article/us-volkswagen-electric-ahome-idUSKBN2BG2MN
17 - Ibid.
18 - https://www.spglobal.com/ratings/en/research/articles/210422-the-hydrogen-economy-for-light-vehicles-hydrogen-is-not-for-this-decade-11911374

In short, we expect metals demand to shift from high levels of cobalt and nickel towards less expensive counterparts such as iron, manganese and materials including phosphate.

b. Battery recycling is another option to meet strong demand

Recycling and the circular economy are two key themes in the metals sector, which are particularly true for metals used in electric vehicles. Electric vehicle development is based on the achievement of the Paris agreement's goals, and as such, the fight against climate change should also encompass how key materials for this revolution are produced. For instance, cobalt mining, like every mining process, has a significant impact on the environment, but also on communities living at proximity. In the Democratic Republic of Congo (DRC), which accounts for approximately two-thirds of global extracted cobalt, deforestation and child labour are widespread. Such issues should be tackled to give the EV revolution all the credit it aims for. Recycling is one answer to reduce reliance on polluting activities and the impact on the environment. We already discussed the rise in demand for key battery and EV metals, but apart from reducing or mitigating demand (notably by incentivising households not to own a car), allowing for battery recycling will definitely be a strong answer. Cobalt and nickel recycling is a mature industry, with the global rate reaching 60%[19] when other metals and alloys are considered first. Lithium is rarely recycled, as the global rate reaches a mere 1%. There is room of improvement for some metals, although higher rates are achieved, such as with copper where a rate of 45% is generally accepted[20]. However, this figure could be improved with better waste management. The key issue here (issue of rate aside) would be: is the quality of recycled metal good enough to allow a reprocessing into new batteries? It seems that battery recycling is already on its way to be more widespread.

As usual, carmakers set the stage with their business partners. In Sweden, the battery maker Northvolt is building a plant to recycle battery cells, up to 50%. In this venture, Volkswagen is a key partner and investor, while Northvolt already teamed up with BMW in another one, as BMW is also a Northvolt investor. With millions of electric vehicles sold, recycling will be a key issue in the coming years and many companies are rushing to develop their own operations in this segment. Northvolt is an example, but many start-ups are working with original equipment manufacturers such as Panasonic (the Japanese Tesla supplier) to recycle cells that do not fit their stringent processes. Furthermore, as battery makers are pouring money to develop devices with longer lifespans (for some configurations, 15 years can be reached), refurbishment or reuse of already existing batteries will develop in the near future, easing the pressure on metal supply. We can expect that used but still viable batteries could enjoy a second life like traditional spare parts of a vehicle. Compared to reprocessing and from the information at hand currently, we think that this segment will represent only a tiny part of recycling.

ESG IN THE GLOBAL METALS INDUSTRY (MINING AND METALWORKING COMPANIES): A DOUBLE-EDGED SWORD.

The metals industry is known for its high impact on the environment and on human activities. The set of environmental, social and governance criteria helps investors to fund activities that take into account not only profit seeking, but also the impact on labour, suppliers, workers' relations, and if the environment is deeply affected by the company's business[21]. What is at stake for miners and metals companies is their ability to secure funding as the awareness of investors is growing. Bad reputation over child labour is definitely a risk for cobalt producers and their customers in the ICT world, so is destroying the rainforest to access rare metals deposits.

Moreover, workers' safety, protecting human rights of communities affected by exploration and production activities, rehabilitating soils or protecting animal and vegetal species after the closing of mines are key for companies producing ESG assessments. The ESG framework forces companies to incorporate the costs of their activity on human beings and their environment, and as such, EV development will help companies evolving in niche markets (lithium extraction for example) to access to cheaper funding[22]. However, this is a double-edged sword, as environmental activists are able to meddle and push companies on the defensive when their business does not factor in the potential negative externalities on workers, dwellers, and the environment.

However, mining companies are known to be very secretive about environmental and social issues, which pushes activists to start inquiries to understand and inform the world of what is at stake in some mines. BHP Billiton has to pay for the rehabilitation of an Aboriginal site in Australia that was destroyed to process iron ores. Vale not only had to pay billions of dollars after the Brumadinho catastrophe in 2019[23], but also had to incorporate stringent safety rules in its processes after the company suffered financially, alongside its investors[24]. Some voices raised concerns about compromising performance over safety and respecting the environment. However, incorporating ethical points within investing will not disappear soon as public opinion, public authorities and many companies are pushing for stricter norms.

19 - Reducing new mining for electric vehicle battery metals: responsible sourcing through demand reduction strategies and recycling, Institute for Sustainable Futures, University of Technology Sidney, April 2021.
20 - Ibid.
21 - https://www.bbva.com/en/sustainability/what-are-the-esg-environmental-social-and-governance-criteria-and-why-are-they-important-for-investors/
22 - https://apac.cib.natixis.com/m-a-pulse-in-apac-articles/focus-on/articles/esg-investments-in-mining
23 - https://www.mining.com/web/esg-seen-as-biggest-risk-to-mining-industry/
24 - https://www.reuters.com/article/us-vale-sa-esg-brazil-focus-idUSKBN27C0R5

COFACE SA
1, place Coste et Bellonte
92270 Bois-Colombes
France

www.coface.com

July 2021 - Layout: Cécile Bélonie - Photo © Shutterstock

coface FOR TRADE