

The price of green extractivism

A critical examination of the global lithium market, pricing mechanisms and lithium extraction in Chile

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Summary

Recent debates around green extractivism have highlighted the negative socio-ecological consequences that come with the increased extraction of critical minerals like cobalt or lithium needed for green technologies such as batteries for electric vehicles (EVs). However, limited attention has been paid to the prices and pricing of these minerals. This article assesses the global lithium market and lithium extraction in Chile, where much of the global lithium reserves are located and shows how the current pricing system in the lithium market is greatly contested. Current pricing mechanisms lack transparency and are linked to different interests of powerful institutions, like the London Metal Exchange (LME) or Price Reporting Agencies (PRAs).

Over the past ten years, there has been a great surge in declarations advocating for a zero-carbon world (Pitron 2022). Numerous countries globally have developed aims to steer the global and national economy away from relying on fossil fuels. For example, the US Inflation Reduction Act (IRA), introduced in 2022, aims to curb inflation by reducing the budget deficit, while meeting long-term emissions targets by supporting clean energy projects with \$369 billion until 2032 (EPA 2023). The EU responded to the IRA with the Net-Zero Industry Act 2023, a key part of the European Green Deal Industrial Plan, which aims to produce at least 40% of the technology needed to meet the EU energy targets domestically by 2030 (Friedrich Ebert Stiftung 2023).

The drive towards a zero-carbon future has permeated specific industries and many countries worldwide are placing high hopes in green technologies. However, these technologies are not without their challenges, as their growing demand is driving up the need for several minerals that are essential to this green transition and are therefore often referred to as “critical minerals” (Voskoboynik/Andreucci 2022). Photovoltaic systems, wind turbines, batteries for electric vehicles (EVs) and other zero-carbon technologies require minerals like cobalt, lithium, nickel and copper (Bridge/Faigen 2022). A growing body of literature on the extraction of these minerals and related activities – often referred to as “green extractivism” – examines how this increasing demand, coming mainly from countries in the Global North entail negative socio-ecological consequences. The latter include problems such as high CO₂ emissions, water pollution, the displacement of local communities, and problematic working conditions, especially in countries of the Global South, where most of the mineral reserves are located. It is argued that this could (re-)produce uneven development outcomes and lead to increased resource dependency and associated economic instability; but this time under a green banner (Jerez et al. 2021; Romero Toledo et al. 2017; van den Brink et al. 2020). Critical

scholars also warn that green extractivism leads to new geopolitical tensions, as minerals such as cobalt and lithium are relatively scarce and concentrated geographically and have historically been used in small quantities. Furthermore, they are largely processed in China (Pitron 2022; Riofrancos 2023).

At the same time, the pricing of minerals needed for green technologies has been largely side-lined in the critical research on green extractivism. Prices of minerals and natural resources have been characterised by cyclical boom and bust patterns. While recent events such as the Covid-19 pandemic and the Russian invasion of Ukraine have caused significant fluctuations in commodity prices and supply disruptions (Schäfer 2022), the current commodity boom is also linked to the regulations of the energy transition (Dorn et al. 2022). For example, lithium prices in August 2021 were US\$ 12.250/tonne, and by August 2022 they had quadrupled to US\$ 50.500/tonne (Benchmark Mineral Intelligence 2022). The large price swings of critical minerals, such as lithium in recent years, illustrate the high instability of these markets and show how price risks should be an essential part of the debate around any sustainability transformation. The processes by which mineral prices are determined and their use in commodity transactions have important distributional implications for different actors and locations and should play a role in the debate on the environmental and social feasibility of this green transition. Yet, little attention has been paid to how critical mineral prices are determined and the underlying factors that drive these processes. This is particularly important as the demand for critical minerals is expected to increase significantly in the coming years.

As lithium has been described as the “world’s hottest commodity” (The Economist 2016) due to its importance in the production of lithium-ion batteries for EVs, the focus of this article will be on the global lithium market and, in particular, on lithium extraction in Chile as one of the largest lithium producing countries. With the example of the global and local lithium market, this article shows that the procedure for determining (critical mineral) prices is greatly contested. Current pricing mechanisms lack transparency and are linked to different interests of (powerful) institutions, like the London Metal Exchange (LME) or independent pricing agencies that are locally distant from the actual place of extraction, which makes it difficult to consider long-term risks such as ecological degradation. At the local level, lithium price setting is linked to the extractive sector in the Atacama Desert in Chile and is embedded in historical and political economy contexts and particularly benefits lithium producers in Chile. The article builds on interviews^I with independent pricing agencies, a lithium producer, an NGO employee, and other sector experts as well as a literature review. Using the example of lithium extraction in Chile, I examine the black box of critical mineral pricing, how pricing processes take place in the lithium market, who wields power in this process, who benefits, and what this means for social and environmental concerns.

“The 20th century was the era of black gold—the 21st will undoubtedly be the era of metals” (Pitron 2022: 136)

Critical minerals – which the EU defines as minerals that are economically important and at the same time represent a high supply risk (European Commission 2020) – are highly concentrated geographically. Over 55 % of the world’s lithium reserves, are located in the so-called lithium triangle between Chile, Bolivia and Argentina in South America. The Democratic Republic of Congo (DRC) accounts for 60 % of the world’s cobalt extraction, South Africa holds 84 % of the world’s rhodium reserves and 69 % of the world’s graphite comes from China (Martin et al. 2017; Pitron 2022).

Chinese companies currently have a considerable influence on the global production of critical minerals and green technologies. For instance, China currently dominates the manufacturing of lithium-ion batteries with a share of over 70 %. More recently, the EU and the US responded to the dominance of Chinese firms with increased support of domestic mining projects and gigafactories (Riofrancos 2023) as well as bilateral agreements with producer countries. The EU, for instance, has recently signed a trade agreement with Chile to secure lithium supply (Spiegel 2023). For the EU and the US, another strategy to achieve autonomy from China and for securing supplies of minerals such as lithium is to become “greener”, as they will not be able to compete on cost with Chinese technologies. Becoming greener in this context involves an interlocking set of justifications, that emphasises environmental and ethical credentials – that are currently demanded by the automotive sector as they are promising sustainability to its customers – towards China. Fast-track environmental permits and the rise of green bonds which finance extractive projects but often lack accountability for sustainable impacts, illustrate this (Jones et al. 2020, Riofrancos 2023). Here, states do not operate in a vacuum and actively engage in the private sector. In 2017, for example, the EU has introduced the EU Battery Alliance to channel public funds to private entities to build out the battery value chain in the EU. Corporations like extractive firms in Europe welcome this type of government support as it not only reduces their costs, but also allows them to present themselves as green, which is attractive to consumers and thus allows these companies to play an active role in the green transition. At the same time, especially carmakers warn against decoupling from China, stressing that over-regulation could stifle innovation and be very expensive for them because they would have to be prepared to pay a green premium on lithium prices if lithium is sourced “sustainably”. The latter is remarkable, given that mining is one of the most damaging and least value-adding stages in a global value chain with a record of human rights violations and environmental toxicity (Riofrancos 2023).

This illustrates that there is increasing global competition in the race for critical minerals which have only recently become global minerals due to their role in green technologies. Lithium extraction has been increasing sevenfold between 2000 and 2020 (Reichl/Schatz 2023) and with the current ambitions, the EU would need almost 60 times more lithium by 2050 compared to 2020 (European Commission 2020). Despite current developments in recycling technologies, the capacity to recycle lithium-ion batteries is expected to remain low. On the one hand, recycling costs are still higher than extraction costs, and on the other hand, the materiality of lithium, which varies greatly between extraction sites and also after processing, makes it difficult to develop

consistent recycling technology (Huang et al. 2018). Therefore, the growing demand for primary lithium products is accompanied by increased extraction in the lithium triangle in South America and elsewhere, and thus growing dependence by EU countries, but also by China and the US. Lithium's use for EV batteries in the context of a green transition has significant implications for the ecosystems at its place of extraction, the rights of communities living close by and the distribution of value and wealth in producer countries. As prices play a crucial role in driving extraction and trade, it is essential to understand the contestation around and beyond pricing mechanisms.

Mineral pricing at a global level: the influence of financial market actors and private price providers

Most minerals are traded globally under bilateral contracts, where two parties agree on specific terms for the trade. These terms include not only the price, but also details such as commodity specifications, quantity, place and time of delivery. Contracts are often based on prices published by commodity exchanges or by independent price providers (Johnson 2018). The London Metal Exchange (LME) plays a leading role as the world's largest non-precious metals trading centre. There, trading in derivatives (contracts that derive value from an underlying asset) by mining companies, battery and car manufacturers and financial players determines global price benchmarks that are then used in bilateral contracts (Radetzki/Wårell 2020). The LME was founded in 1877 to facilitate physical trade and provide risk management through hedging for physical metal traders, producers, and end-users. These players were marginalised with the entry of powerful banking groups such as Goldman Sachs and JP Morgan in the 1970s (Seddon 2020). As a result, there is less actual physical trading on the LME today and its market structure is increasingly driven by financial market participants taking positions for investment and speculative purposes. For example, many financial actors use futures contracts not to reduce price risk, but rather to expose themselves to price volatility, speculating to profit from sudden price increases (Seddon 2020). The structural changes of these markets have been associated with the "financialization of commodity markets" (Seddon 2020; Tang/Xiong 2012). Authors have noted a correlation between increasing price volatility and rising commodity prices with the growing influence of financial actors on exchanges (Tang/Xiong 2012). With a larger share of financial actors, prices no longer necessarily reflect movements in the fundamentals of the underlying asset but are influenced by financially driven strategies that take on price risks for profit (Basak/Pavlova 2016).

While the LME trades commodities that have a standardized quality and are traded frequently, minerals that are less standardizable and don't yet have many buyers and sellers, are often priced by independent price providers, in particular so-called Price Reporting Agencies (PRAs). In the last few years, PRAs – such as Benchmark Mineral Intelligence (BMI) or Fastmarkets – who originally saw themselves as industry journalist magazines, have started to get involved in providing financial data and prices for various commodities that market participants can draw on. PRAs use opaque methodologies to collect information on current prices and contracts by talking to different market

participants such as mining companies, traders, cathode producers, and battery and car manufacturers (Interview 1; Johnson 2018). They normalize these prices by removing outliers and publish them on their website, where they are accessible to market participants for a fee. Price information is particularly important for commercial users in commodity markets, and as price discovery on a case-by-case basis is an expensive and complex process, market participants in sectors with lower trading volumes increasingly use PRA price data as the reference price in their contracts (Radetzki/Wärell 2020).

Some critical minerals, such as lithium still do not have a large market compared to established metals such as copper (Barandiarán 2019). Despite its relatively small market share and the difficulties in standardising lithium due to the diverse geographical and climate conditions in lithium-producing countries, the LME has launched a lithium futures contract in June 2021. The underlying price of this contract is the lithium hydroxide price published by the PRA Fastmarkets. Since then, however, there has been no trading activity on this contract. So far, lithium prices are still being determined through direct negotiations between producers and consumers (Comisión Nacional del Litio 2013; Interview 2,3).

This problematizes the processes leading to world prices in minerals and metals markets. The increasing role of purely speculative interests is problematic, as it increases volatility and instability. More generally the LME and PRAs as the key price determination institutions in the minerals and metals market lack transparency and democratic legitimacy.

Case Study: Lithium extraction in Chile and lithium pricing

Lithium in Chile is extracted from salt brines in the Atacama Desert, the Salar de Atacama in northern Chile. There it affects water supply and ecosystems, causing territorial conflicts between indigenous communities, multinational companies and the state (Dorn/Gundermann 2022). Due to different national laws dating back to the dictatorship of Augusto Pinochet (1973-1990), to date, lithium – a state-owned resource – is only mined by two companies: the Chilean company Sociedad Química y Minera (SQM) and the U.S.- American firm Albemarle. Both companies have mining contracts with the state agency Corfo and produce lithium carbonate, as is common when lithium is extracted from salt brines (León et al. 2020). Different lithium-ion technologies use different lithium materials, but the lithium-iron-phosphate (LFP) battery technology, which uses lithium carbonate, currently dominates the market, driving lithium demand in South America (Barandiarán 2019). The dominance of LFP-batteries might also be a reason of why the LME futures contract on lithium hydroxide has not been traded since its launch (London Metal Exchange 2023).

Albemarle and SQM are deeply intertwined with political and economic power in Chile which has distributional consequences for the Chilean society. Albemarle, which began mining lithium in 1998, was accused by Corfo in 2018 of avoiding to pay taxes in Chile while shifting profits to its US-based headquarters, though it has denied all accusations (Orellana 2017; Terrel 2018). SQM has been accused of illegal financing of politicians, ecological damage, and non-compliance with the lease contract with Corfo.

The company is also linked to, and still partly controlled by, Pinochet's former son-in-law, who came to power during the second wave of privatisation in Chile under Pinochet (Poveda Bonilla 2020). A Chinese company – Tianqi – has acquired around 20 % of SQM's shares but otherwise foreign companies have not been able to acquire shares, nor have they been able to start mining lithium in Chile due to strict state policies (Bos/Forget 2021). Although SQM obtained their mining concession in the 1980s, they did not begin extracting lithium in the Salar de Atacama until 1998 (Dorn/Gundermann 2022). When SQM entered the market, their strategy was to offer large discounts on the previous lithium prices in order to gain market share and make large profits. After that, pricing became very competitive, and it has been difficult to obtain price information as negotiations between producers and their buyers took place individually and behind closed doors (Maxwell 2015).

In the wake of the general commodity super-cycle, the lithium market worldwide, and in Chile in particular, experienced a major boom in the 2000s. Competition increased, and price levels were publicly reported again (Maxwell 2015). To date, however, the global lithium market has different pricing regimes. The results of some interviews in Chile (Interview 2,3,4) showed, that there is a move towards reference prices and floating price formulae (e.g., reference price plus premium or discount) and away from fixed prices due to the uncertainty and instability of the market, which leads to large price fluctuations. As a result, bilateral contracts today tend to be shorter than they were a few years ago. It should also be noted that, due to tight supply, a large proportion of lithium trading is also done on the very opaque spot market for immediate delivery and in one-off transactions, with spot prices that are sky-high compared to contract prices (Jorratt 2022). However, neither in the contract market nor in the spot market is there a global benchmark (exchange-based or PRA-based reference price), which makes lithium pricing very opaque (Comisión Nacional del Litio 2013; Jorratt 2022; Poveda Bonilla 2020).

For many players like battery producers and automakers, the access to lithium is currently the decisive factor, which puts lithium producers in a strong negotiating position. A benchmark price that physical actors like lithium buyers could base their negotiations on, could indeed benefit them. This is primarily because global benchmarks limit the transaction costs for (re)negotiations (Johnson 2018). In Chile, the missing global benchmark only further strengthens the power of lithium producers towards their buyers. In 2020, for example, battery producers started to approach Chilean lithium producers directly – instead of buying from cathode producers – because they wanted to secure supply. However, they couldn't sign contracts because they wanted to buy from SQM and Albemarle at low prices to be competitive with non-EVs. The lithium producers, however, were in a good position to reject low offers due to high demand (Interview 3). Secondly, a global benchmark can provide access to risk-management for certain actors. The original motivation to even introduce a futures contract for lithium at the LME arose from the idea to make risk-management through hedging possible for small firms and start-up companies (Interview 5). According to one interviewee (Interview 3), Chilean lithium producers don't currently engage in risk management at all due to their strong position.

However, benchmark prices that are currently determined on commodity exchanges or by PRAs should not be seen neutral or objective. How can they reflect the interests

of the physical players in the lithium market when the LME is dominated by financial institutions and players who want to profit from sudden price increases? The LME has undergone significant structural changes, with powerful financial players dominating international trade, which in turn influences price levels. Moreover, the fact that PRAs, alongside derivative markets and financial actors, drive world prices is rarely discussed. Although PRA methodologies are public, the way they are applied in practice is highly discretionary. PRAs have the power to decide which actors to include in their price assessments, these prices are very exclusive due to the subscription fees, and PRA prices usually lack a comprehensive classification of specific transport costs and trading conditions. So, how can prices even reflect on social and ecological aspects – like the water shortage in the Atacama Desert – if they are decoupled from the actual locations of extraction in producer countries?

In Chile, lithium pricing is currently in a transition phase with a move towards using shorter contracts, PRA reference prices and floating price formula. Besides global price determination that is influenced by financial players and other actors far away from the centre of extraction, national regulations in producer countries can influence price levels, through tax and duty policies, and labour and environmental regulations. Recent developments such as Gabriel Boric's (Chilean president who was elected in 2021) plan to create a National Lithium Company may influence the lithium sector in the near future. Boric wants this company to be based on public-private partnerships, with the state (through its agency Corfo) playing a leading role in lithium extraction and private companies contributing capital and technological know-how (Gob.cl 2023). In discussions about the creation of a National Lithium Company, (transparent) pricing doesn't seem to be a major issue. However, Boric continues to highlight the involvement of local communities in the Salar de Atacama. In May 2023, for instance, the Chilean Congress approved a new mining royalty bill that will collect taxes from lithium producing companies and distribute them directly to the territories and regional communities for compensating for the socio-ecological damages (Fundación Terram 2023; KPMG 2023). In a country where almost all power has been centralised, environmental organisations see this as a major step forward for social and territorial justice. However, civil society organisations stress that paying for environmental costs should be the direct responsibility of mining companies, and that royalties should instead be used to benefit society, for example to fund social rights programmes (Fundación Terram 2023). Given that water use is the biggest environmental issue in the Atacama Desert – one of the driest places on earth (Jerez et al. 2021) – another point of criticism is that the royalties in the lithium sector are based solely on the amount of lithium exported, and not on the amount of salt water pumped from the brines (Interview 5). In Chile, the opacity of pricing mechanisms and the lithium production system in general as well as its control by only two companies, combined with a political system in which the power emanates from the centre and where smaller regions and territories have very little power, weakens the chances of establishing alternative production systems.

Outlook

The global demand and competition for mineral raw materials has risen sharply in the context of green technologies such as e-mobility, and so have their prices. Lithium as the main component of lithium-ion batteries is considered critical for EVs and thus in current debates around sustainability transformations. The socio-environmental downsides associated with any form of extractivism – including green extractivism – have fuelled discussions on how to regulate the extraction of minerals for green technologies. At the same time, debates around prices behind critical minerals such as lithium have largely been sidelined. This article is an attempt to show how the current pricing system in the lithium market is greatly contested. On the one hand, it must be criticised how lithium producers have a powerful position in setting prices in negotiations with their buyers due to current supply and demand patterns. On the other hand, lithium producers are also influencing the current shift towards a benchmark system, which is dominated by the practices of the current price providers, the LME and PRAs, which both lack transparency and democratic legitimacy and therefore need to be problematised *per se*. When talking about a just socio-environmental transformation, the discussion should include whether and how prices can reflect the social realities and ecosystems of areas where critical minerals are extracted. The commodification of nature creates new capitalist regimes of accumulation (Wissen 2013), that are embedded in asymmetric power structures globally and locally. Here, questions such as ‘Whose interests are really reflected in commodity prices?’ must be asked. Besides the financial dimension of green extractivism, the political economy in producer countries need to be considered to better understand distributional socio-ecological effects of increased mineral extraction. The quickly emerging lithium market is highly volatile, which can be illustrated with the sharp decrease in lithium prices in January 2023, as China cut EV subsidies, what significantly reduced Chinese demand (Larsen 2023). Therefore, it is difficult to consider long-term risks and costs, especially for producer countries. This article has highlighted the contradiction between the currently dominant narrative of sustainable transformations and the ongoing, fast-developing extractive activities in the mineral sector, which are not without their economic, geopolitical, environmental, and social challenges.

Note

- 1 The interviews considered in this article were conducted in the course of either my Master’s thesis “Prices behind electro-mobility – Contestation around and beyond price determination and setting in the lithium global production network and extraction in Chile” which received support through the short-term grant (KWA) by the University of Vienna or the project “The role of commodity prices for socio-ecological transformation” by the Department of Development Studies in cooperation with ÖFSE.

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 Interview 3: Head of market at a lithium producing company in Chile. Santiago, Chile
 Interview 4: Employee of a Chilean governmental organisation in Chile. Santiago, Chile
 Interview 5: Sector expert. London, UK
 Interview 6: Economist working for a NGO with a focus on sustainability. Santiago, Chile

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