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Study

Value Addition in the Context of Mineral Processing

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List of abbreviations

CORE	Center of Reform on Economics
CRM	critical raw material
CRMA	Critical Raw Materials Act
CSIS	Center for Strategic and International Studies
DPM	Dundee Precious Metals
DPMT	Dundee Precious Metals Tsumeb (Pty) Limited
DRC	Democratic Republic of the Congo
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EFA	European Free Alliance
EITI	Extractive Industries Transparency Initiative
EU	European Union
EV	electric vehicle
HRW	Human Rights Watch
IEA	International Energy Association
IMF	International Monetary Fund
IRENA	International Renewable Energy Agency
IRMA	Initiative for Responsible Mining Assurance
KPA	Consortium for Agrarian Reform / Konsorsium Pembaruan Agraria
NGO	non-governmental organisation

ODG	Observatorio de la Deuda en la Globalización
OECD	Organisation for Economic Co-operation and Development
PIIE	Peterson Institute for International Economics
PSN	National Strategic Project / Proyek Strategis Nasional
RMAP	Responsible Minerals Assurance Process
RMI	Responsible Minerals Initiative
S&Ds	Socialists and Democrats
SQM	Sociedad Química y Minera de Chile
SWP	German Institute for International and Security Affairs/ Stiftung Wissenschaft und Politik
TNI	Transnational Institute
UAE	United Arab Emirates
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
VRFB	vanadium redox flow battery
WEF	World Economic Forum

Introduction

The global shift towards renewable energy, the digitalisation of our economies and societies, and increased demand by defence and space industries mean that demand for many metals is set to increase.^[1] The European Commission (EC) has identified a list of what it calls critical raw materials (CRMs),^[2] which it considers to be minerals for which there is increased demand and for which the European Union (EU) is prioritising «reliable and unhindered access»^[3] as one of the pillars of the EU's strategy for raw materials.^[4]

Increased demand for CRMs developed in the past decade, alongside more recent market disruptions for some of these metals due to the Russian Federation's invasion of Ukraine.^[5] This – combined with its apparent growing political discomfort about its dependency on China for mineral raw materials^[6] – has prompted the EU to focus its attention on accessing both the raw ores and concentrates of CRMs, and crucially on also being able to access CRMs in their processed forms for product manufacture.

At present, the processing of some CRMs – the act of turning raw ores and concentrates into usable chemicals and metals – is highly concentrated within global supply chains. This

- 1** European Commission, Proposal for a Regulation of the European Parliament and of the Council Establishing a Framework for Ensuring a Secure and Sustainable Supply of Critical Raw Materials and Amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020 COM/2023/160 final, Explanatory Memorandum, 1. Context of the Proposal, Reasons for and Objectives of the Proposal, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0160>
- 2** The definition of CRMs is contested.
- 3** European Commission, Critical Raw Materials, undated, https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en (last accessed 13 July 2023). However, academics and studies note that presently there is no universally accepted definition of critical materials. For example, in a 2022 study, IRENA noted that the factors for determining criticality remain subjective and location-specific. Core criteria typically include economic importance (for a specific economy of interest) and level of supply risk, as influenced by factors such as scarcity and proximity of supply, complexity of extraction and refining processes, concentration of supply across different parts of the value chain, and lack of viable substitutes; see IRENA, World Energy Transitions Outlook 2022: 1.5°C Pathway, Abu Dhabi, <https://www.irena.org/publications/2022/mar/world-energy-transitions-outlook-2022>.
- 4** European Commission, Internal Market, Industry, Entrepreneurship and SMEs, undated, https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest_en
- 5** OECD, The Supply of Critical Raw Materials Endangered by Russia's War on Ukraine, 4 August 2022, <https://www.oecd.org/ukraine-hub/policy-responses/the-supply-of-critical-raw-materials-endangered-by-russia-s-war-on-ukraine-e01ac7be/>
- 6** Think Tank European Parliament, Critical Raw Materials Act, 27 September 2023, [https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI\(2023\)747898](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2023)747898) (at 1 minute 50 seconds), and SWP, The Future of European-Chinese Raw Material Supply Chains, 16 May 2023, <https://www.swp-berlin.org/10.18449/2023C27/>

increases supply chain risk, creates bottlenecks that are vulnerable to economic or geopolitical shocks,^[7] and can lead to this leverage being used to flex political muscle.

The EC's proposed text of the European Critical Raw Materials Act (CRMA) asserts that this situation «exposes the EU to significant supply risks» and proposes that the Union invest in strategic projects inside and outside of the Union that build its capacity to access processed minerals.^[8] In addition, the European Parliament's September 2023 proposed text of the CRMA includes a target for processing 50 per cent of the EU's annual consumption of CRMs within the Union.^[9] The parliament also voted that «Strategic Partnerships» (see Box A)^[10] with mineral producer nations could be used to increase the EU's mineral processing capacity by up to 20 per cent.^[11] Since at least the enactment of the 2011 Raw Materials Initiative, the EU has recognised that most of the raw materials needed for its industries come from outside of the Union.^[12]

EU literature often describes Strategic Partnerships and their stated commitments to develop domestic mineral processing as beneficial to producer nations. According to the proposed text of the CRMA, Strategic Partnerships are a commitment between the Union and a third country to «increase cooperation related to the raw materials value chain that is established through a non-binding instrument setting out concrete actions of mutual interest» and that will «add value» locally.^[13]

- 7** EnergyPost.EU, Critical Minerals and Materials: Supply Bottlenecks and Risks Need International Cooperation, 25 February 2022, <https://energypost.eu/critical-minerals-and-materials-supply-bottlenecks-and-risks-need-international-cooperation/>
- 8** European Commission, Proposal for a Regulation, Chapter 6 (see note 1).
- 9** S&Ds: Critical Raw Materials Act Ensures Access to Resources from Abroad and Their Substitution Where Possible, 14 September 2023, <https://www.socialistsanddemocrats.eu/newsroom/sds-critical-raw-materials-act-ensures-access-resources-abroad-and-their-substitution>
- 10** European Commission, Proposal for a Regulation, Chapter 6 (see note 1).
- 11** S&Ds: Critical Raw Materials Act (see note 9).
- 12** European Commission, Raw Materials Diplomacy, https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/raw-materials-diplomacy_en
- 13** European Commission, Proposal for a Regulation, Chapter 1, Article 2, Definitions (62) and Preamble (54) (see note 1). For example, the July 2023 Memorandum of Understanding on establishing a partnership between the EU and Chile on sustainable raw materials value chains signed by the EU Commissioner, Thierry Breton, and the Minister of Foreign Affairs of Chile, Alberto van Klaveren Stork, states that «[t]he partnership aims to deepen cooperation in the field of sustainable raw materials value chains that are necessary for the clean energy and digital transition of both partners. It also aims to develop a competitive and sustainable industry for processing raw materials and local value added in the mining sector, creating quality employment and sustainable and inclusive economic growth, to the mutual benefit of both sides»; see European Commission, Global Gateway: EU and Chile Strengthen Cooperation on Sustainable Critical Raw Materials Supply Chains, 18 July 2023, https://ec.europa.eu/commission/presscorner/detail/en/IP_23_3897

Box A: EU Strategic Partnerships: Definitions in EU literature

Strategic Partnerships are described in European Commission literature as promoting the «economic development» of producer countries «in a sustainable manner through value chain creation, while also promoting secure, resilient, affordable, and sufficiently diversified value chains for the EU». [14] They have also been called «win-win» partnerships [15] and «partnerships of equals» that reflect «Europe's long-term commitment to the sustainable recovery in each of our partner countries». In its Global Gateway strategy, the European Commission describes partnerships that create «strong and sustainable links – not dependencies between Europe and the world – and they build a new future for young people». [16]

These generous descriptions of the EU approach are not universally shared, however. Differing views to the EU's added value narrative are explored throughout this study.

But what is meant by value creation in practice? Value can be defined in many different ways.

In economic terms, a classical definition has the production of new goods and services at its heart. [17] Economic value may also include how outputs are produced, how they are shared across the economy, what is done with the earnings created, and whether what is being created is useful. [18]

In the age of the Anthropocene, [19] we must additionally ask if what is being produced increases or decreases the resilience of the productive system. Put another way, we might ask whether or not what is being produced allows the planet and all of its people to flourish. For example, and as pointed out by economist Mariana Mazzucato, if a factory is polluting

14 European Commission, Global Gateway: EU and Chile Strengthen Cooperation (see note 13).

15 Euractiv, EU Pushes Alternative Model to China in Global Race for Raw Materials, 31 May 2023, <https://www.euractiv.com/section/circular-economy/news/eu-pushes-alternative-model-to-china-in-global-race-for-raw-materials/>

16 European Commission, Global Gateway: Up to €300 Billion for the European Union's Strategy to Boost Sustainable Links around the World, 1 December 2021, https://international-partnerships.ec.europa.eu/news-and-events/news/global-gateway-eu300-billion-european-unions-strategy-boost-sustainable-links-around-world-2021-12-01_en

17 Mariana Mazzucato, *The Value of Everything*, Penguin Random House, 2018, p. 6.

18 Ibid.

19 The Anthropocene Epoch is an unofficial unit of geologic time used to describe the most recent period in Earth's history when human activity started to have a significant impact on the planet's climate and ecosystems, see National Geographic, «Anthropocene», undated, <https://education.nationalgeographic.org/resource/anthropocene/>, and ScienceDirect, «Anthropocene», undated, <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/anthropocene>

so much that it is destroying the system around it, it may be valuable economically but become non-valuable overall.^[20] This understanding of value, which is systemic in its considerations, is in stark contrast to the predominant theory of value applied in much of the world today, in which value is determined by the dynamics of price, due to scarcity and preferences.^[21]

Moreover, as this study finds, even if the value addition of mineral processing is considered only in these narrow economic terms, the act of mineral processing may not add much to a country's economy by way of economic value. However, this study argues that value is not only about money. What we value in society goes far beyond the narrow confines of economic definitions. Safe and fair working conditions, a healthy lived and working environment, equality, and flourishing nature are valued throughout most societies and should be included when considering value addition.

If it does intend to add value for producer nations and its own member states that is not restricted to economic value, the EU will have to confront these non-financial, non-economic considerations as it looks to diversify its supply chains and build or access mineral processing capacity.

Drawing on existing public reporting, primary source interviews, and exchanges with academics and industry experts, this study provides a snapshot of what «adding value» looks like, or not, in the context of mineral processing as it is done today. It examines what mineral processing may bring in terms of economic value addition and proposes that the assessment of and planning for value addition linked to mineral processing should be much broader than economic value. It should encompass environmental and social metrics that create ecologically safe and socially just spaces for humanity, in line with those proposed by economist Kate Raworth.^[22]

This study has found that there is no shared, agreed understanding about what value addition should look like for mineral processing. It proposes that this understanding must be agreed through free and informed consultation prior to the agreement of Strategic Partnerships, including with communities and indigenous groups, and that companies and governments must abide by the highest transparency principles by publishing information about the planned and actual value addition of mineral processing, including environmental and social value. It proposes that communities and citizens should have the right to say «no», particularly the right to refuse mineral processing projects – after having been consulted in

20 Mazzucato, *The Value of Everything*, p. 6 (see note 17).

21 IMF, *Supply and Demand: Why Markets Tick*, undated, <https://www.imf.org/en/Publications/fandd/issues/Series/Back-to-Basics/Supply-and-Demand> (last accessed 13 September 2023).

22 Kate Raworth, *Donut Economics*, 2017, Penguin Random House.

an informed way. Finally, it also proposes that technological transfer to producer countries is part of value addition.

In addition, it observes that debates around value addition must remain cognisant of the reality that «green» refining remains an emerging field for which relatively few standards and studies have been developed to date, and for which best practice is scarce. And, although CRMs are currently touted as being central to society's response to the climate crisis, experts continue to raise questions about the current CRM «rush», pointing to information gaps about their supply, and also about the inequalities that the CRM paradigm risks further entrenching.

Based on 20 days of desk research, 22 interviews, and material drawn from two CRM-focused international conferences, this study does not include fieldwork. It examines individual cases that illustrate what mineral processing currently looks like for 6 of the 34 CRMs on the EC's fifth (2023) list.^[23] Lithium and nickel processing were selected because of the heightened attention on these metals due to their use in electric vehicle (EV) batteries. Vanadium was selected because of its use in vanadium redox flow batteries (VRFBs), and because – relative to other CRMs – there has been comparatively less research on vanadium processing. Other case studies were selected following a literature review as they were considered to be informative and instructive when considering added value in mineral processing.

To the extent that writing comprehensively about such «wicked problems»^[24] is even possible, the study provides a brief case study about a copper processor in Namibia, examines planned hard-rock lithium processing facilities in DRC and existing brine processing in South America, and takes a cursory look at vanadium processing in South Africa. Drawing on secondary sources, it briefly reviews the added value of aluminium and nickel processing in Brazil and Indonesia, respectively. Finally, it formulates recommendations for the European political debate in October 2023.

This study concludes that, left unreformed, mineral processing will perpetuate the wrongs of the current fossil fuel-based system by worsening toxic pollution, biodiversity loss, environmental damage, and deepening social inequalities in some countries, and will also exacerbate the decarbonisation divide^[25] (see Box B). This will occur whilst covering it all

23 European Commission, Critical Raw Materials (see note 3).

24 Stonybrook University, What Is a Wicked Problem, undated, <https://www.stonybrook.edu/commcms/wicked-problem/about/What-is-a-wicked-problem>; see also H. W. Rittel & M. M. Webber, «Dilemmas in a General Theory of Planning», *Policy Sciences*, 4(2)(1973), 155-169, <https://www.cc.gatech.edu/fac/ellendo/rittel/rittel-dilemma.pdf>

25 Benjamin K. Sovacool et al., «The Decarbonisation Divide: Contextualizing Landscapes of Low-carbon Exploitation and Toxicity in Africa», *Global Environmental Change*, 60(2020), <https://www.sciencedirect.com/science/article/pii/S0959378019305886>

up with arguments and rhetoric about financial or economic value add for producer countries, while producing metal to meet the global shift towards renewable energy, the digitalisation of our economies and societies, and the increased demand by defence and space industries.^[26]

Box B: What is the decarbonisation divide?

A 2020 academic study^[27] published in *Global Environmental Change* introduced the term «decarbonisation divide».

According to the definition provided by the 2020 study, the decarbonisation divide is the difference between how academic literature focusses on technologies and innovations needed for low-carbon transitions, such as EVs and solar panels, and the downstream and upstream processes, such as mining and waste flows, that these technologies create and which result in toxic pollution, biodiversity loss, exacerbation of gender inequality, exploitation of child labour, and the subjugation of ethnic minorities.^[28]

The study concluded that we must all, as researchers, planners, and citizens, broaden the criteria and analytical parameters we use to evaluate the sustainability of low-carbon transitions.

The study also questions the criticality of the so-called CRMs that are at the centre of this latest industrialisation drive. A 2018 paper published by the Society of Economic Geologists points out, for example, that the global resources and reserves of a number of critical metals as well as their production statistics remain unclear; that information quantifying the resources of critical metals is provided by the mining industry; and that other information gaps mean that significant parts of our knowledge base on the supply (and the security of this supply) of the critical metals remain opaque.^[29]

In his 2002 book *Globalisation and its Discontents*, economist Joseph Stiglitz reflected on his time at the World Bank during the 1990s. He explains that decisions were made «often because of ideology and politics», leading to «wrong-headed decisions» that «did not solve the problem at hand but that fit with the interests of beliefs of people in power». In the rush to feed the defence and aerospace demand and in an apparent scramble for resources

26 European Commission, Proposal for a Regulation (see note 1).

27 Sovacool et al., «The Decarbonisation Divide» (see note 25).

28 Ibid.

29 S. M. Jowitt et al., «The Critical Metals: An Overview and Opportunities and Concerns for the Future», 2018, Society of Economic Geologists (incl. SEG Special Publications), 21, pp. 25-38.

against China, the EU risks falling into this trap – unless the question of value addition is considered beyond the investments and revenues generated.

Mineral processing and economic value addition

Mineral processing – also referred to as smelting and refining – is often viewed in today's global economy as a way of creating domestic economic value addition for a country. That could be done by achieving higher market prices for exports because processed CRMs typically yield a higher market value than raw ores and concentrates^[30] or done through job creation, attracting other downstream industry, or building that country's resilience in global supply chains.

Using publicly available information and interviews with experts and activists living in mineral-producing countries where mineral processing is taking place, the following section reviews some of the current thinking about the economic value addition of mineral processing.

30 IRENA, Geopolitics of the Energy Transition: Critical Materials, 2023, https://mc-cd8320d4-36a1-40ac-83cc-3389-cdn-endpoint.azureedge.net/-/media/Files/IRENA/Agency/Publication/2023/Jul/IRENA_Geopolitics_energy_transition_critical_materials_2023.pdf?rev=f289d177cda14b9aaf2d1b4c074798b4, p. 93.

1. Mineral processing may add economic value, but often does not take place in mineral-producing countries

At present, much of the economic value-addition work produced by smelting and refining, but also battery cell assembly and ultimately EV production, takes place outside of the countries that produce the raw materials. This has been termed «green-grabbing» by some, whereby non-producer countries benefit from green technologies whereas producer countries remain stuck at the bottom of the value chain, and the people living in the countries providing the raw materials often live in poverty, including energy poverty.^[31]

Box C: Mineral processing locations

In many cases, the mineral processing and manufacturing facilities that turn raw ores into useable chemicals or metals are not located in the producer countries^[32] that provide CRMs. For example, in 2021 Australia and Chile were the world's largest raw lithium producers,^[33] but China processed 50 per cent of the world's lithium.^[34] Indonesia was by far the largest nickel producer, but China, which ranked seventh in world production, processed 56 per cent of the world's nickel.^[35] And even though the Democratic Republic of the Congo (DRC), Indonesia, and Russia dominate raw cobalt production, China processed 69 per cent of cobalt that year (but didn't even make it into the top 10 producer countries for cobalt).^[36]

31 Rosa Luxemburg Foundation, Will Europe's Transition Mean Africa's Deindustrialisation?, 20 April 2023, <https://www.rosalux.de/en/news/id/50285/will-europes-transition-mean-africas-deindustrialization>

32 Such as DRC, Mozambique, Peru, Ghana, Indonesia, Chile, Argentina, Bolivia, and Brazil; see ODG, The Mine, The Factory, The Store, 20 July 2023, <https://odg.cat/en/publication/booklet-the-mine-the-factory-the-store/>

33 WEF, This Chart Shows Which Countries Produce the Most Lithium, 5 January 2023, <https://www.weforum.org/agenda/2023/01/chart-countries-produce-lithium-world/>

34 ODG, The Mine, p. 28 (see note 32).

35 Melissa Pistilli, «Top 9 Nickel-producing Countries» (updated 2023), Investing News Network, 29 May 2023, <https://investingnews.com/daily/resource-investing/base-metals-investing/nickel-investing/top-nickel-producing-countries/>

36 Lauren Kelly, «Top 10 Cobalt Producers by Country» (updated 2023), Investing News Network, 17 August 2023, <https://investingnews.com/where-is-cobalt-mined/>

In order to try to add economic value to their natural resource wealth, a growing number of producer country governments are therefore taking steps to encourage domestic CRM processing and to attract downstream industries.^[37]

For example, export restrictions for critical materials are on the rise, with several countries implementing major export bans in order to promote mineral processing domestically. Zimbabwe banned the export of raw lithium in December 2022^[38] to encourage Chinese firms to build factories there instead of exporting lithium to China for processing.^[39] Around the same time, Namibia prohibited the export of raw lithium and other critical materials.^[40] Indonesia banned the export of nickel in 2019 as a way to attract foreign investment in battery manufacturing on shore^[41] – an action that spurred the EU to initiate a World Trade Organization dispute against the ban.^[42] Indonesia also required majority local ownership of some companies. In 2017, Tanzania passed laws requiring mining companies to give the government at least a 16 per cent stake in their operations and process their ore locally.^[43]

Dubbed «resource nationalism»^[44] by some^[45] and «metallic nationalism» by others,^[46] defensive strategies based on internal tools have become increasingly popular in resource-rich developing economies. Given the current global imbalance in resource

37 IRENA, *Geopolitics of the Energy Transition*, p. 57 (see note 30).

38 *Godfrey Marawanyika* and *Ray Ndlovu*, «Raw Lithium Exports Banned in Zimbabwe as Demand and Prices Soar», Bloomberg, 20 December 2022, <https://www.bloomberg.com/news/articles/2022-12-20/zimbabwe-bans-raw-lithium-exports-with-immediate-effect>

39 *Jevans Nyabiage*, «Export Ban Means Chinese Firms Will Have to Build Plants in Zimbabwe to Process Lithium», South China Morning Post, 30 December 2022, <https://www.scmp.com/news/china/diplomacy/article/3205135/export-ban-means-chinese-firms-will-have-build-plants-zimbabwe-process-lithium>

40 Nyasha Nyaungwa, «Namibia Bans Export of Unprocessed Critical Minerals», Reuters, 8 June 2023, <https://www.reuters.com/markets/commodities/namibia-bans-export-unprocessed-critical-minerals-2023-06-08/>

41 Koya Jibiki, «Indonesia's Nickel Export Ban Spurs Rush into Vital EV Metal Supplier», NikkeiAsia, 20 May 2023, <https://asia.nikkei.com/Business/Materials/Indonesia-s-nickel-export-ban-spurs-rush-into-vital-EV-metal-supplier#:~:text=Hoping%20to%20move%20his%20country,responded%20by%20laying%20down%20capital>

42 WTO, DS592: Indonesia – Measures Relating to Raw Materials, https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds592_e.htm

43 Reuters Staff, «Tanzania's President Signs New Mining Bills into Law», Reuters, 10 July 2017, <https://www.reuters.com/article/us-tanzania-mining-idUSKBN19V23P>

44 Resource nationalism exists in consumer countries as well as producer countries.

45 Halina Ward, *Resource Nationalism and Sustainable Development: A Primer and Key Issues*, IIED, March 2009, <https://www.iied.org/sites/default/files/pdfs/migrate/G02507.pdf>

46 Victor Crochet and Weihuan Zhou, *Critical Insecurities? The European Union's Strategy for a Stable Supply of Minerals*, Working Paper, May 2023, <https://ghum.kuleuven.be/ggs/wp237-eu-critical-minerals.pdf>

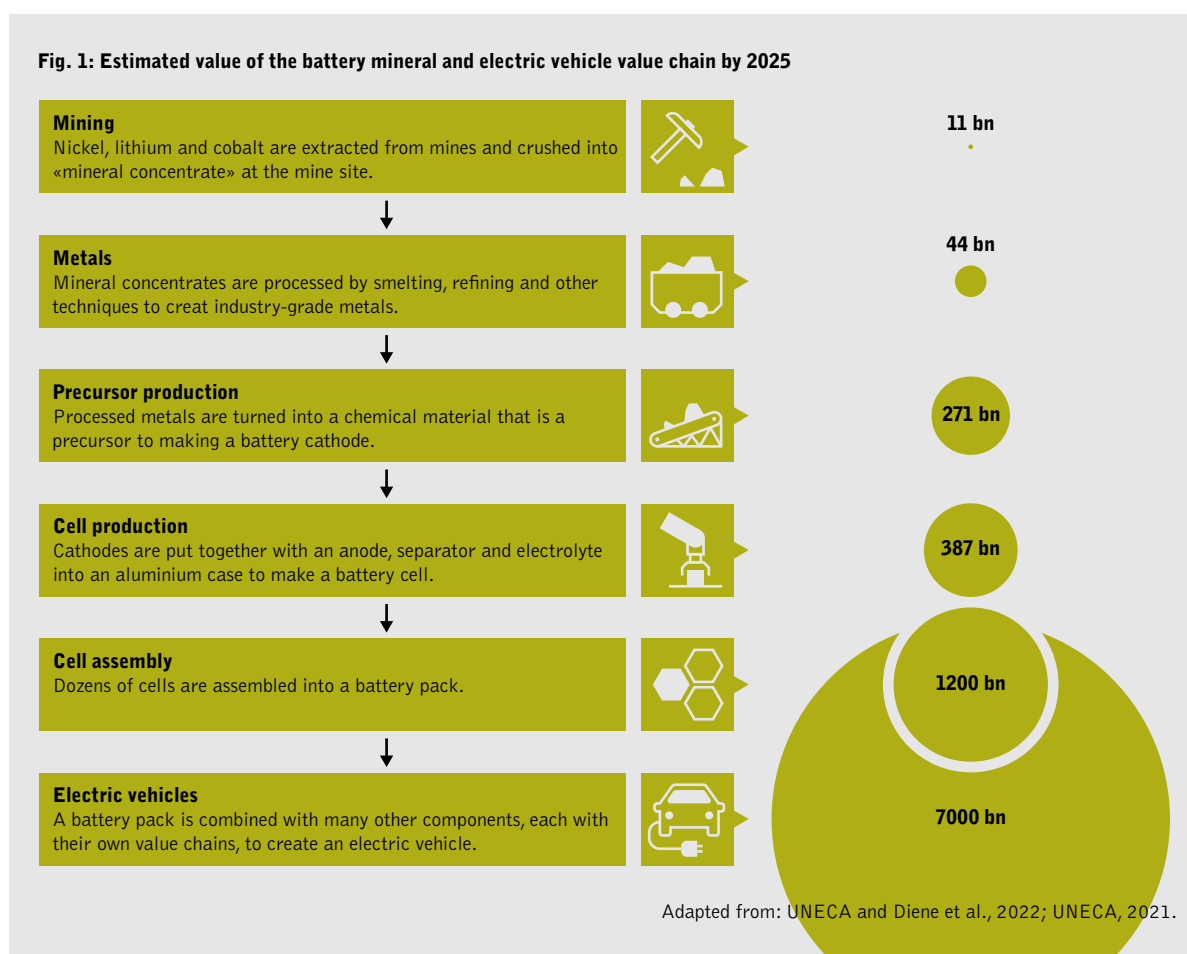
distribution and who benefits from it, these strategies in part attempt to combat «green-grabbing», whereby non-producer countries benefit from green technologies whilst people living in the countries providing the raw materials live in energy poverty.^[47]

47 Rosa Luxemburg Foundation, Will Europe's Transition Mean Africa's Deindustrialisation? (see note 31).

2. Mineral processing adds economic value, but not as much as other activities further down the value chain

Smelting and refining only represent the tip of the iceberg where economic value addition of raw materials is concerned. A 2023 study from the International Renewable Energy Agency

(IRENA) estimates, for example, that the value of mining nickel, lithium, and cobalt for battery and EV value chains was USD 11 billion, whereas the value from the manufacture of EVs was a much greater USD 7,000 billion (see Figure 1 below). Figure 1 also illustrates that the mining of nickel, lithium, and cobalt has only a 0.6 per cent share in the total EV value chain – 1.1 per cent if metal smelting and refining are included – whereas manufacturing battery cells and selling EVs that use these metals yields a much greater value addition in terms of price.^[48]



48 IRENA, Geopolitics of the Energy Transition, p. 93 (see note 29).

3. Economic value addition is not guaranteed by domestic mineral processing

Increased global demand for CRMs could provide opportunities for producer countries to move «up» the financial value chain by attracting investment to build up their processing (and manufacturing) capacities and encouraging higher-margin activities, in addition to increasing their primary ore exports.^[49] The Observatorio de la Deuda en la Globalización considers this to be an opportunity for producer countries to break out of their economically subordinate position in global supply chains.^[50]

However, two current examples of domestic mineral processing suggest that this assumption does not always turn out to be true.

In the first example, South Africa's two vanadium processors - which are two of only four operational primary vanadium processors in the world - have struggled financially of late. Owned by Bushveld Minerals Limited, a company registered in Guernsey,^[51] has facilities located at Vametco and Vanchem.^[52] Bushveld's website states that the company is «well on its way to achieve its target of being one of the most significant, low-cost primary vanadium producers».^[53] Even so, the company has made financial losses in recent years^[54] and come under fire from some of its investors.^[55] Former CEO and co-founder of the mine, Fortune Mojapelo, told South African media that although the Vametco mine had performed well, the Vanchem vanadium processing facility had not yet lived up to expectations.^[56]

49 PIIIE, Building Downstream Capacity for Critical Minerals in Africa, December 2022, <https://www.piie.com/sites/default/files/2022-12/pb22-16.pdf>

50 ODG describes how countries in the Global South have a primary-export matrix and mostly engage in mineral extraction and sales with basic refinement and processing or, economically, low value-added terms, for example in DRC, Mozambique, Peru, Ghana, and Indonesia; ODG, *The Mine*, p. 14 (see note 31).

51 Bushveld Minerals, Directory, <https://www.bushveldminerals.com/contact/directory/>

52 Bushveld Minerals, 2019 Annual Report and Financial Results, <https://www.bushveldminerals.com/wp-content/uploads/2022/07/Bushveld-Minerals-2019-Annual-Report-Financial-Results.pdf>, p. 3.

53 Ibid.

54 David McKay, «Bushveld Shares Hit Fresh Low as New CEO Cuts Vanadium Target», *Miningmx*, 2 August 2023, [https://www.miningmx.com/news/ferrous-metals/54074-bushveld-shares-hit-new-5-year-low-as-new-ceo-cuts-vanadium-target/#:~:text=For%20the%202022%20financial%20year,\(2021%3A%20%2D%2434m\)](https://www.miningmx.com/news/ferrous-metals/54074-bushveld-shares-hit-new-5-year-low-as-new-ceo-cuts-vanadium-target/#:~:text=For%20the%202022%20financial%20year,(2021%3A%20%2D%2434m))

55 Lisa Steyn, «Bushveld Minerals Hits Six-year Low as Long-serving CEO and Co-founder Departs», *News24*, 21 June 2023, <https://www.news24.com/fin24/companies/bushveld-minerals-hits-six-year-low-as-long-serving-ceo-and-co-founder-departs-20230621>

56 Ibid.

Bushveld told the Heinrich Böll Foundation that the company considers itself «poised as a key player in a market increasingly reliant on primary producers to fulfil the rising demand for vanadium», that they were «focussed on optimising production capacity» and had an immediate short-term objective of establishing a «robust, sustainable, and cash-generating production foundation» to ensure the stability of operations while positioning the company for future growth.

The company told the Heinrich Böll Foundation that it attributed its financial losses to a combination of lower vanadium prices, higher inflation, load shedding, raw material costs, and operational challenges due to the overall challenging operating environment. Bushveld added that plant breakdowns at Vanchem and unscheduled power disruptions owing to the lack of reliability of the municipality's infrastructure and delays in the use of better-quality third-party ore had contributed to the processing facility's losses. It further added that it had recently implemented initiatives to stabilise Vanchem's production, and had consequently achieved a 63 per cent improvement in average production for July and August over the monthly average for the first six months of the year.

South Africa is the world's third-largest vanadium producer,^[57] and the mining sector has for a long time been an important foreign exchange earner and employer in the country. But South Africa's mining sector has performed poorly in recent years, in part due to drops in commodity prices, electricity shortages, and logistical challenges.^[58] In 2023, mining companies across the country have signalled significant retrenchments.^[59] At an October 2023 conference entitled «Critical Raw Materials: For Whom? At What Cost?», the General Secretary of the South African Communist Party, Solly Mapaila, described how some mining communities where mines were closing were not informed of closures, and also discussed the need for a skills audit to prepare communities for new work opportunities once mines leave.

Analysts are divided about what future mineral processing, including of vanadium, could bring to South Africa, noting that on one hand, more beneficiation of South Africa's minerals through processing and manufacture could bring better outcomes, whereas others point out that a century of mining and processing in the country has only brought benefits for a

57 US Department of the Interior, Vanadium, 2022, <https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-vanadium.pdf>

58 *Adelaide Changole*, «Falling Prices, Power Cuts Halve South Africa Miners' Profits», Bloomberg, <https://www.bloomberg.com/news/articles/2023-10-04/falling-prices-power-cuts-halve-south-africa-miners-profits?leadSource=verify%20wall>

59 Luyolo Mkentane and Thando Maeko, «News Analysis: Transnet Woes Signal Mining Job Losses», Business Day, <https://www.businesslive.co.za/bd/national/2023-10-06-news-analysis-trans-net-woes-signal-mining-job-losses/#:~:text=Domestic%20and%20international%20factors%20have,relegate%20breadwinners%20to%20unemployment%20lines>

very few.^[60] Additionally, vanadium in particular is a hazardous material to mine and treat, and its processing has significant environmental and social impacts. These are examined in Section 4 below.

In a second example, a report released in September 2023 by AEER (Aksi Ekologi dan Emansipasi Rakyat, or People's Emancipation and Ecology Action), an Indonesian non-governmental organisation (NGO), raises questions about who has benefited from the capital flows generated by increased nickel processing in the country. The report stated that the «economic exploitation degree» in two key nickel-producing and -processing areas, Morowali and North Morowali, was very high: AEER calculated that for 2022, around 95.65 per cent of gross regional domestic product in Morowali exited the region, leaving only the remaining 4.35 per cent to be enjoyed by local residents.

The report also suggests that the lion's share of 95.65 per cent is enjoyed by investors, who are mainly Chinese and received incentives and tax holidays, Chinese foreign labours who received three times the salary of Indonesian workers, and Chinese companies that buy the midstream nickel products from Indonesia at a relatively cheaper price under the Belt and Road Initiative.^[61]

Stania Puspawardhani, author of a forthcoming paper on the value chain of Indonesia's EV industry at the Center of Reform on Economics (CORE) Indonesia, commented for this study that «capital flows to those who have capital in the first place. If local residents don't have much, they may get some side effects like jobs – or local landlords, for example, can sell land for 10 times higher prices and become wealthy rich. This is unsustainable, however, and most of the profit is enjoyed by core capitalist countries like the US or China.» She added that «if we don't have the technology [in Indonesia], we stay at the bottom of the global value chain. In fact, Indonesia is still largely at the bottom of the global value chain, despite its ambition to be the center of global EV industry.^[62] Our added value is only a little and other countries get greater benefits. The local narrative is that 'we are going to benefit from global supply chains' but there needs [to be] a change of perspective. The public needs to understand where we are at in the EV industry, so we can have just and robust policy that benefits all.»

60 Benchmarks Foundation, «Critical Raw Materials: For Whom? At What Cost?», Annual Conference, 10 October 2023; interviews with two analysts working in South Africa, October 2023.

61 The figures are calculated by «Mubyarto theory», developed by Indonesian economist Mubyarto, <https://www.aeer.or.id/2023/09/23/perusahaan-perusahaan-multinasional-dan-hilirisasi-nikel-di-indonesia/>

62 Arief Aszhar, «Berambisi Jadi Penguasa Industri Kendaraan Listrik Dunia, Indonesia Ajak Negara ASEAN Lain», *Liputan*, 8 May 2023, <https://www.liputan6.com/otomotif/read/5279837/berambisi-jadi-penguasa-industri-kendaraan-listrik-dunia-indonesia-ajak-negara-asean-lain>

She further added that «while it is greatly heralded that mineral processing will boost the country's economic growth, recently published findings from UNU-Wider^[63] show that economic growth alone will not be enough to end poverty. Stronger emphasis^[64] is needed on inclusive growth and productive capacities, alongside social policy. The focus should entail redistribution alongside growth, through policies that build productive capacities, or expand income transfers to meet the extreme poverty target.»

63 *Arief Anshory Yusuf* et al., Will Economic Growth Be Sufficient to End Global Poverty?, Working Paper 123/2023, UNU-WIDER, <https://www.wider.unu.edu/publication/will-economic-growth-be-sufficient-end-global-poverty>

64 Duncan Green, Will Growth Be Enough to End Poverty? New Projections of the UN Sustainable Development Goals, Oxfam, 17 October 2023, <https://frompoverty.oxfam.org.uk/will-growth-be-enough-to-end-poverty-new-projections-of-the-un-sustainable-development-goals/>

4. Economic value addition commitments in the EU's Strategic Partnerships

Recently negotiated Strategic Partnerships to secure EU access to raw materials – proposed between the EU and producer countries – have included investment in mineral processing as part of the EU commitment to create domestic added value for its partners, according to published text about the agreements. For example, a July 2023 Memorandum of Understanding between the EU and the Republic of Chile on a Strategic Partnership on Sustainable Raw Materials Value Chains contains commitments on «the development of local added value, processing, manufacturing and recycling centres as drivers for economic and social development and domestic revenue mobilisation».^[65] It also commits both countries to developing an «internationally competitive and sustainable industry for processing and adding value in mining [...] favouring the manufacture of semi-finished products and final consumption both in the country and abroad».^[66]

Although the proposed text of the CRMA cites added value as one of the grounds for its proposal,^[67] there is no clear stated definition of what value addition means in the proposed text of the CRMA. More broadly, there is no shared, agreed understanding as to what value addition should look like for mineral processing – within EU Strategic Partnerships or beyond them. In the words of a raw materials policy and mining expert interviewed for this study, «unless it is clearly defined, value added becomes a political slogan that can be wielded. For it to mean anything in practice, it is a concept that needs to be unpacked».^[68] This understanding must be agreed through free and informed consultation prior to the agreement of Strategic Partnerships, including with communities and indigenous groups. As interviews throughout this study highlight, and particularly in the case studies below, individuals living in areas where mineral processing took place did not see economic value addition as being the single most important benefit that mineral processing should or could bring.

65 European Commission, Internal Market, Industry, Entrepreneurship and SMEs, Memorandum of Understanding between the European Union and the Republic of Chile on a Strategic Partnership on Sustainable Raw Materials Value Chains, 18 July 2023, https://single-market-economy.ec.europa.eu/publications/memorandum-understanding-eu-chile-sustainable-raw-materials_en

66 Ibid.

67 Added value of Union involvement (it may result from different factors, e.g. coordination gains, legal certainty, greater effectiveness, or complementarities). For the purposes of this point «added value of Union involvement» is the value resulting from Union intervention, which is additional to the value that would have been otherwise created by member states alone; see European Commission, Proposal for a Regulation, Chapter 6 (see note 1).

68 Interview, Raw Materials Policy and Mining Expert, DRC, October 2023.

Some commentators reflect that the economic terms offered by the EU in its recent efforts to secure access to raw materials position the bloc as a development partner^[69] – a shift away from its previous pattern of neocolonial extraction.^[70] Others strongly disagree, considering that nothing has changed.^[71] They note that the recent Chile deal overlooks the significant environmental and social damage that has already been caused by Chile's extractive industries – including mineral processing activities – and that it continues to blindly prioritise increased production, economic growth, and security of supply^[72] for EU markets.

Box D: Defensive strategies by industrialised nations

Mineral-rich producer countries that aim to climb up the mineral value chain may face trade barriers: industrialised countries often place tariffs that are higher for manufactured goods than those for raw materials (a process that is known as «tariff escalation»). Future import tariffs may be tied to emissions – as under the EU's Carbon Border Adjustment Mechanism – which, in terms of metals, will initially cover only steel and aluminium, even though its product scope may be extended to cover copper, zinc, nickel, and silicon, among others, according to reporting by IRENA.^[73] The production of these minerals is now subject to a carbon price under the EU's Emissions Trading Scheme, although this means that the minerals are exposed to a significant risk of carbon leakage,^[74] such as for aluminium and steel.^[75]

- 69** Alan Beattie, «EU Seeks to Tone Down the Imperial Style in Search for Critical Minerals», *Financial Times*, 23 March 2023, <https://www.ft.com/content/fe8d650d-19b9-482d-ab96-be692620e407>
- 70** See, for example, Europe's neocolonial relationship with raw material-rich countries, as described by Friends of the Earth Europe, *The EU's Industry Alliances: The New Corporate Capture That Threatens Democracy and the Environment*, May 2021, <https://friendsoftheearth.eu/wp-content/uploads/2021/05/The-EUs-Industrial-Alliances.pdf>; see also European Network of Corporate Observatories, *So That Everything Can Stay the Same*, October 2021, <https://corpwatchers.eu/en/investigations/european-multinationals-and-authoritarian-regimes/so-that-everything-can-stay-the-same>
- 71** Ibid.
- 72** TNI, *Transition Minerals from the World's Most Arid Ecosystem*, July 2023, <https://www.tni.org/en/article/water-predators-the-industry-behind-green-energy>
- 73** IRENA, *Geopolitics of the Energy Transition*, p. 116 (see note 30).
- 74** Carbon leakage refers to the situation that may occur if – for reasons of costs related to climate policies – businesses were to transfer production to other countries with laxer emission constraints. This could lead to an increase in their total emissions. The risk of carbon leakage may be higher in certain energy-intensive industries; see European Commission, *Carbon Leakage*, undated, https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/carbon-leakage_en
- 75** IRENA, *Geopolitics of the Energy Transition*, p. 116 (see note 30).

At an October 2023 conference in South Africa organised by the NGO Benchmarks Foundation, Yao Graham, coordinator of the Third World Network Africa, commented that in his view, the CRMA is about Europe and «not about the rest of us». According to his analysis, the deals being made by the EU with producer countries lock in the EU's needs above those of other countries. Mr Graham warned that, alongside replacing fossil fuels, the energy transition is also about who controls the resources and technologies of the future.

4.1. The political value add of processing

At present, the processing of some CRMs is highly concentrated within global supply chains. China currently accounts for 100 per cent of the world's refined supply of natural graphite and dysprosium (a rare earth element), 70 per cent of cobalt, and almost 60 per cent of lithium and manganese – even if these raw materials are not produced in the country itself – according to a new study by IRENA.^[76] In some cases, this has created bottlenecks that are vulnerable to economic or geopolitical shocks^[77] or that, on the other side, can be used to flex political muscle.

For example, China's July 2023 decision to restrict gallium exports had global impacts on semi-conductor manufacture,^[78] with perceived ramifications for national security for some nations.^[79] China currently produces around 80 per cent of the world's gallium, which can only be processed at facilities in China, Japan, and by one company each in Europe and Canada, respectively.^[80] EU demand for gallium is expected to grow 17-fold by 2050.^[81] This puts China in a relatively powerful political position where global access to gallium is concerned.

In another example, the Russian Federation's invasion of Ukraine created significant market uncertainty for metals produced in Russia such as aluminium, nickel, palladium, and vanadium.^[82] As above with China, this can put Russia in a position of political power, where access to these processed metals can become a bargaining chip.

76 IRENA, *Geopolitics of the Energy Transition*, p. 13 (see note 30).

77 EnergyPost.EU, *Critical Minerals and Materials* (see note 7).

78 Twitter, Javier Blas, 3 July 2023, <https://twitter.com/JavierBlas/status/1675872776568164355>

79 Matthew P. Funaiole, Brian Hart, and Aidan Powers-Riggs, *Mineral Monopoly, China's Control over Gallium Is a National Security Threat*, CSIS, 18 July 2023, <https://features.csis.org/hiddenreach/china-critical-mineral-gallium/>

80 Dominique Patton, Mai Nguyen, and Melanie Burton, «What Are Gallium and Germanium and Which Countries Are Producers?», Reuters, 7 July 2023, <https://www.reuters.com/markets/commodities/where-are-strategic-materials-germanium-gallium-produced-2023-07-04/#:~:text=Gallium%20is%20found%20in%20trace,China%2C%20according%20to%20the%20CRMA>

81 European Commission, *Proposal for a Regulation* (see note 1).

82 OECD, *The Supply of Critical Raw Materials* (see note 5).

As such, some producer countries that are not yet major players in CRM processing have identified opportunities to create their own political added value by increasing their domestic processing capabilities – in some cases also outlining plans for domestic battery manufacture.

For example, in April 2022 the DRC and Zambia signed an agreement to build an EV battery factory in Lubumbashi, DRC,^[83] an initiative that the United States supported in March 2023,^[84] followed by commitments of logistical support from the EU in September 2023.^[85] The US^[86] and EU moves are widely seen as attempts by western governments to strike alliances to challenge China's dominance in CRM supply chains.^[87] A mineral processing expert agreed with this analysis, and also underlined the geopolitical role of investment from the United Arab Emirates (UAE) in mineral processing in DRC, and elsewhere.

In another example, a June 2023 report – co-financed by the Asian Clean Energy Fund and established by the Government of Japan under the Clean Energy Financing Partnership Facility administered by the Asian Development Bank – recommended that the Government of India prioritise setting up domestic CRM refining and processing facilities in order to build its own resilience in domestic battery supply chains.^[88] The report also recommends that the government prioritise CRMs for batteries as «a key pillar of [the] Indo-Pacific economic framework and a key factor in diplomatic outreach with mineral bearing foreign

83 Radio Okapi, «Coopération Zambie-RDC: implantation d'une usine des batteries électriques à Lubumbashi», <https://www.radiookapi.net/2022/04/29/actualite/societe/cooperation-zambie-rdc-implantation-dune-usine-des-batteries>

84 CSIS, The U.S.-Zambia-DRC Agreement on EV Batteries Production: What Comes Next?, 6 March 2023, <https://www.csis.org/analysis/us-zambia-drc-agreement-ev-batteries-production-what-comes-next>

85 *Jorge Valero*, «Europe Lines Up African Minerals Pacts to Ease Reliance on China», Bloomberg, 27 September 2023, <https://www.bloomberg.com/news/articles/2023-09-27/europe-lines-up-african-minerals-pacts-to-ease-reliance-on-china?leadSource=verify%20wall>

86 A July 2023 US Subcommittee bill requiring the creation of a US national strategy to secure supply chains of critical minerals from DRC is linked to the fact that DRC produces about 70 per cent of the world's cobalt, the majority of which is processed in China. Alongside cobalt, DRC also has major deposits of copper, lithium, tantalum, and germanium. According to the draft bill, the dominance of Chinese companies in the extraction, processing, and refining of these minerals «represents an economic and national security threat» that impacts US energy independence and military preparedness; see *Michael J. Kavanagh*, «US Bill Aims to Counter China Control of Congo Critical Minerals», Bloomberg, 13 July 2023, <https://www.bloomberg.com/news/articles/2023-07-13/us-bill-aims-to-counter-china-control-of-congo-critical-minerals?leadSource=verify%20wall>

87 *Valero*, «Europe Lines Up African Minerals Pacts» (see note 85).

88 Sudhendu J. Sinha et al., Mine to Market: Critical Minerals Supply Chain for Domestic Value Addition in Lithium-ion Battery Manufacturing, NITI Aayog, June 2023, https://www.niti.gov.in/sites/default/files/2023-07/Mine-to-market_NITI-Aayog-Publication_June-2023.pdf, p. 9.

countries»,^[89] indicating the geopolitical strategic importance that processing facilities can have.

Non-producer countries are also taking steps to build up their domestic CRM processing capacity. In 2021 the Australian government announced an AUD 2 billion fund to develop critical mineral processing in Australia.^[90] The US Inflation Reduction Act of 2022 requires percentages of minerals for EVs to be processed in the United States or in a country with which it has a Free Trade Agreement in order to qualify for clean vehicle credits.^[91] A metal trading expert interviewed for this study added, however, that all governments, from producer and non-producer countries, should be aware of the risk of over-investing in processing capacity, thereby creating a processing «bubble» that over-anticipates future demand.

In fact, efforts by non-producer countries to secure access to raw and processed metals is nothing new. The 2011 EU Raw Materials Initiative recognised that access to raw materials on global markets was a priority, and the EU committed to pursuing Raw Materials Diplomacy by «reaching out to non-EU countries through Strategic Partnerships and policy dialogues».^[92] A mineral processing expert interviewed for this study explained that a recent increase in off-take agreements, whereby buyers agree in advance to purchase mineral producers' upcoming production output, was indicative of market worries about access to CRMs.

The proposed text of the CRMA aims to increase mineral processing within the Union, and in September 2023 the European Parliament voted in favour of including a target for processing 50 per cent of the EU's annual consumption of CRMs domestically.^[93] Strategic Partnerships^[94] are also identified as a tool with which the EU could increase its mineral processing capacity by up to 20 per cent.^[95]

89 Ibid.

90 IEA, Australia 2023 Energy Review, <https://iea.blob.core.windows.net/assets/02a7a120-564b-4057-ac6d-cf21587a30d9/Australia2023EnergyPolicyReview.pdf>

91 Covington & Burling LLP, Much-Anticipated Proposed Regulations on the 30D EV Tax Credit Have Finally Arrived, <https://www.insideenergyandenvironment.com/2023/03/much-anticipated-proposed-regulations-on-the-30d-ev-tax-credit-have-finally-arrived-but-leave-a-key-question-unresolved/>

92 European Commission, Raw Materials Diplomacy (see note 12).

93 S&Ds: Critical Raw Materials Act (see note 9).

94 European Commission, Proposal for a Regulation, Chapter 6 (see note 1).

95 S&Ds: Critical Raw Materials Act (see note 9).

4.2. Value addition is not just financial

«You can ask yourself, value addition for whom? If it is not for the people living around these mines also, that's an injustice and only capitalists are benefiting from this.»

Mathapelo Thobejane, activist, South Africa

Although the economic value addition of mineral processing has been relatively widely discussed for decades, the environmental and human costs of mining and processing minerals such as lithium and rare earths have largely been hidden from view of the citizens of many countries – including industrialised economies, such as those in the EU – prioritising instead economic concerns as the main focus.^[96]

These «costs» are not financial, but they are «paid» – usually by people and the planet in the form of environmental degradation, poor working conditions, health impacts on local populations, and so on. This study does not argue for the inclusion of natural capital as a monetised ecosystem service^[97] when the value addition of mineral processing is being discussed. Rather, it argues that environmental and social impacts should be mitigated in order for societies to flourish, and included as part of value addition considerations.

Part of the problem appears to be cultural: Resource extraction, including mineral processing, has generated environmental and social impacts on populations and thrived on inequalities in producer countries for a very long time, all of which has been tacitly accepted as the cost of doing business. History provides many illustrations of this culture in practice. For example, between the mid-1700s and mid-1900s, Wales produced most of the world's roofing slate^[98] – to the country's economic benefit – whilst its workforce bore the brunt of horrendous working conditions.^[99] In another example, although coal arguably played the

96 IRENA, Geopolitics of the Energy Transition (see note 30).

97 World Forum on Natural Capital, What is Natural Capital?, <https://naturalcapitalforum.com/about/#:~:text=Natural%20capital%20can%20be%20defined,which%20make%20human%20life%20possible>

98 This industry, particularly in the period from 1780 to 1940, dominated the world production of roofing slates, opened up new slate quarries and mines across the world through the cultural transfer of technology and skills, and transformed both the environment and the way of life of those who lived and worked in the mountains of Snowdonia; see The Slate Landscape of Northwest Wales World Heritage Site, Supplementary Planning Guidance, June 2022, <https://snowdonia.gov.wales/wp-content/uploads/2023/02/SPG-Slate-WHS-S.pdf>

99 Slatesite, Pay and Living Conditions, <http://www.llechycymru.info/IPSLPay.english.htm>, and Big Pit National Coal Museum, Questions & Answers – Evidence from the 1842 Mines Report, https://museum.wales/childrenoftherevolution/work/resources/1842mines_report_evidence/

central role in the United Kingdom's Industrial Revolution,^[100] the squalor, over-crowding, and pollution from the burning of coal eventually had major negative economic, as well as social and environmental, impacts.^[101] Today, the way we mine and process CRMs, combined with projections of future demand, suggests that we are set to see the same negative patterns re-occur, and probably on a larger scale,^[102] unless we change the way that we mine and process CRMs.

Box E: Changing behaviours

In order to change the destructive living patterns of many of the Earth's inhabitants, we need to learn to live in a different way that remains within the Earth's planetary boundaries.^[103] That means humans need to undertake a collective transformational adaptation^[104] to the way we live and what we place value on. This, in turn, means a strong reduction in resource consumption by the richest, and a significant (but very feasible) redistribution towards the poorest, with an emphasis on reusing and recycling.^[105]

The global shift towards renewable energy, the digitalisation of our economies and societies, and increased demand by defence and space industries mean that we will continue to access and process the Earth's raw materials – including metals – even if resource consumption is reduced. But this has to be done in new, fairer, and ecologically sound ways, which are critical for a Just Transition.^[106] This is not only about

- 100** E. A. Wrigley, *Energy and the English Industrial Revolution*, 2015, Cambridge University Press, <https://www.cambridge.org/core/books/energy-and-the-english-industrial-revolution/A18E-48989B4A915D0E77A29D57D85763>
- 101** John Turner, «What Can We Learn from the Role of Coal in the Industrial Revolution?», Economics Observatory, 31 August 2021, <https://www.economicsobservatory.com/what-can-we-learn-from-the-role-of-coal-in-the-industrial-revolution>
- 102** ODG, The Mine (see note 32).
- 103** Johan Rockström et al., «Planetary Boundaries: Exploring the Safe Operating Space for Humanity», *Ecology and Society*, 14(2)(2009), <http://www.jstor.org/stable/26268316>
- 104** Tanya Chung Tiam Fook, «Transformational Processes for Community-focused Adaptation and Social Change: A Synthesis», *Climate and Development*, 2017, 9(1)(2017), 5-21, and Robert W. Kates, William R. Travis, and Thomas J. Wilbanks, *Transformational Adaptation When Incremental Adaptations to Climate Change Are Insufficient*, 16 April 2012, <https://www.pnas.org/doi/abs/10.1073/pnas.1115521109>
- 105** Kate Raworth, *Want to Get into the Donut? Tackle Inequality*, <https://www.kateraworth.com/2014/10/16/doughnut-inequality/> (last accessed 30 May 2023).
- 106** The International Labour Organization defines a Just Transition as «[g]reening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind; see UNDP, *What Is the Just Transition? And Why Is It Important?*, November 2023, <https://climatepromise.undp.org/news-and-stories/what-just-transition-and-why-it-important>

switching from fossil fuels to green energy, but also about recognising that current trade and extraction models do not serve the planet and all people. We need to try something else.^[107]

Although a small shift and arguably not a transformational one, within the context of value addition, countries should consider investment in their domestic metal recycling facilities, for example. Some private-sector members are already investing in these technologies as new and strategic avenues to access metals in the future. For example, a September advisory by Jefferies, an investment bank, advised investors to buy shares in Glencore, a large commodity trading company that was investing in its metals recycling business. The advisory stated «[w]hile the contribution of this business to the overall group is small, it is strategically important and is also likely to be a differentiating vehicle for growth that will drive [the company's] relative valuation higher over the next decade. The bottom line is that [the company] is pursuing multiple underappreciated opportunities to create value. Reiterate buy.»^[108]

If it does intend to add value that is not restricted to financial value, the EU will have to confront these non-financial considerations as it looks to diversify its supply chains and build or access mineral processing capacity elsewhere. This is already being debated: One of the key issues in current discussions on the CRMA is whether strategic refining projects should be designated as projects of overriding public interest – meaning they could override environmental laws.^[109]

According to a 2023 IRENA report, it is estimated that a startling 54 per cent of energy transition minerals are located on or near Indigenous Peoples' lands.^[110] As part of its value addition agenda, the EU must also pay attention to the opinions of domestic and overseas populations, which may protest against metal processors being built close to their homes, and listen to their concerns over environmental issues.^[111] As such, the EU must ensure robust and early community engagement with any populations affected by its Strategic Partnerships – which at present, does not appear to be happening.^[112]

107 The Greens/EFA in the European Parliament, An Alternative Narrative on Raw Material Access, July 2023, https://www.annacavazzini.eu/wp-content/uploads/GreensEFA_Raw_Materials-v2_WEB.pdf

108 Jefferies, 19 September 2023, advisory seen by the author of this study.

109 Antonia Zimmermann, «Europe's Green Dilemma: Mining Key Minerals without Destroying Nature», Politico, <https://www.politico.eu/article/europes-green-dilemma-mining-key-minerals-without-destroying-nature/> (accessed 3 October 2023).

110 IRENA, Geopolitics of the Energy Transition (see note 30).

111 Ibid., p. 104.

112 The Greens/EFA in the European Parliament (see note 107).

4.3. Environmental and social impacts of mineral processing: Value subtraction

The negative environmental and social impacts of mineral processing can be significant. Overall, the metals and mining sector is responsible for about 10 per cent of global greenhouse gas emissions, some 7 per cent of which is due to steel production, 2 per cent is due to aluminium production, and the remainder is due to the production of the other metals, including emissions from the processing of critical materials.^[113]

Some mineral processing, such as some lithium processing techniques,^[114] have significant water requirements that create or exacerbate water stress and pose contamination risks^[115] (see below). Processing some rare earth metals can generate radioactive waste,^[116] processing some copper ores can create severe illnesses in surrounding communities,^[117] and nickel processing can contribute to deforestation, among other things.^[118] Oftentimes, however, even when communities protest, mineral processing goes ahead anyway.

This section lays out examples of the environmental and social impacts of mineral processing at sites in Brazil, Malaysia, Chile, Argentina, Indonesia, South Africa, and the United States. It includes one example from DRC, where lithium processing is planned but not yet operational. Following a literature review, it contains an in-depth case study about copper smelting in Namibia that was considered informative and instructive, when considering the debate about added value in mineral processing. It draws on published reporting as well as interviews conducted by the author of this study with individuals and experts living in countries where mineral processing is taking place. The examples include nickel, lithium, vanadium, and copper processing activities, and questions are raised about the added social and environmental value provided to the people living in countries where the processing is taking place.

113 IRENA, *Geopolitics of the Energy Transition*, p. 83 (see note 30).

114 A July 2023 report by ODG, e.g., described the pollution, economic dependence, and even gender-based violence linked to lithium mining and processing nearby Sant Pedro de Atacama, Chile. The impact on local water supplies is enormous – so much so that Francisco Mondaca, member of the Association of Irrigators and Farmers of Toconao, described it as follows: «It isn't lithium mining, it is water mining»; see ODG, *The Mine* (see note 32).

115 IRENA, *Geopolitics of the Energy Transition*, p. 87 (see note 30).

116 Greenpeace, *A Radioactive Ruse: Environmental Threats Posed by the Lynas Rare Earth Element Processing Facility in Malaysia*, June 2014, <https://www.greenpeace.org/static/planet4-malaysia-stateless/2014/06/1d2c0a86-a-radioactive-ruse-online.pdf>

117 CEE Bankwatch Network, *Raw Deal*, January 2021, <https://bankwatch.org/wp-content/uploads/2021/01/RAW-DEAL.pdf>, pp. 13-14.

118 Hannah Brown, «The Trees Were All Gone», *Euronews*, 15 March 2023, <https://www.euronews.com/green/2023/03/15/the-trees-were-all-gone-indonesias-nickel-mines-reveal-the-dark-side-of-our-electric-future>

Aluminium processing in Brazil: Reporting by Human Rights Watch

A 2021 Human Rights Watch report stated that in Brazil's Pará State, an NGO representing more than 11,000 people – including Indigenous Peoples and Afro-Brazilians – has several ongoing legal complaints against Norwegian company Norsk Hydro ASA (Hydro), which operates a bauxite mine, refinery, and aluminium smelter, over the alleged contamination of waterways in the Amazon basin. The Human Rights Watch report also notes that global aluminium production is responsible for more than 1 billion tonnes of CO₂ equivalent annually – around 2 per cent of global greenhouse gas emissions.

Hydro told Human Rights Watch in 2021 that it respects the claimants' right to file the lawsuits and will respond based on the facts and evidence presented in court.^[119] The Heinrich Böll Foundation wrote to Hydro about the matter, to which the company replied that the allegation was not correct, that there were no ongoing legal complaints against Hydro in Brasil in 2021, and that legal complaints were against Brazilian companies, including subsidiaries of Norsk Hydro ASA, Alunorte, Albras, Norsk Hydro Brazil, and Mineração Paragominas S.A. (Paragominas mine). Hydro added that they do not recognise the contamination of waterways as a result of their operations. The Heinrich Böll Foundation notes that the Brazilian company Albras is a joint-venture, in which Hydro has a 92 per cent share,^[120] that it holds a 62 per cent share in Alunorte,^[121] and that Norsk Hydro Brazil is a holding company for Norks Hydro ASA.^[122]

In June 2022 quilombolas and Indigenous Peoples from the municipality of Barcarena in Pará state filed a lawsuit against the company in a court in the Netherlands. The defendants accused the company of being responsible for at least 10 environmental disasters caused by its mining and aluminium production activities. In response to the Heinrich Böll Foundation's email on the matter, Norsk Hydro ASA noted that the Cainquiama association is a member-based association – not an NGO or specific communities/groups from Barcarena and has members from all over Brazil – and that Hydro denies the allegations brought forward by the claimants. Norsk Hydro ASA added that the Dutch case cites nine alleged events over the last two decades, some of which occurred and some that did not, and none of which could have caused the damages alleged by the plaintiffs.

119 HRW, Aluminium: The Car Industry's Blind Spot, 2021, https://www.hrw.org/report/2021/07/22/aluminum-car-industrys-blind-spot/why-car-companies-should-address-human-rights#_ftn40

120 Correspondence with Hydro, October 2023. Hydro told the Heinrich Böll Foundation that the share will go down to 62 per cent «after closing of the deal with Glencore».

121 Hydro, Hydro and Glencore to Become Partners to Further Develop Alunorte, 27 April 2023, <https://www.hydro.com/en-GB/media/news/2023/hydro-and-glencore-to-become-partners-to-further-develop-alunorte/>

122 Hydro, Country by Country Report, <https://www.hydro.com/Document/Doc/Country%20by%20country%20report.pdf?docId=568445>, p. 133.

Rare earths in Malaysia

Australian company Lynas Rare Earths Ltd faced heavy local opposition in Malaysia in 2012 over the health and environmental risks posed by potential leaks of radioactive waste from its proposed rare earth processing facility in the country. The company mines its rare earths at Mount Weld in Western Australia and ships them to its plant in Malaysia for processing. From 2012, activists took to the streets, initiated legal action, and some even went on hunger strike to stop the project.^[123] Even so, the facility began operating in 2013. Protests have continued, however, and the Malaysian government has now said that it wants Lynas to stop the cracking and leaching aspects of its operations by mid-2023.^[124] The Heinrich Böll Foundation wrote to Lynas Rare Earths Ltd about this case but did not receive a reply.

Nickel processing in Indonesia

Today, Indonesia is touted as one of the world's epicentres for nickel smelting,^[125] and it holds the world's largest nickel reserves. Indonesia has leveraged these to attract investment along the battery and EV supply chain.^[126] The country has attracted more than USD 15 billion of foreign investment in nickel processing.^[127]

The overseas investment has in large part been spurred by the introduction of domestic legislation banning the export of unprocessed nickel and bauxite ores and mandating their processing domestically.^[128] Although the ban meant short-term loss of export earnings, mining jobs, and government revenues, it attracted new investment in nickel processing.^[129] Prior to the export ban, Indonesia had only two operating nickel smelters, and by 2020 the number had risen to 13.^[130] As of 2020, the Indonesia Morowali Industrial Park, home to several nickel processing facilities, was a major local employer for up to 43,000 workers and indirectly supported at least another 30,000 small service providers and local

123 John Feffer, *Battling a Mining Goliath on Two Continents*, 2023, <https://www.indigenouspolicy.org/index.php/ipj/article/view/910>

124 IRENA, *Geopolitics of the Energy Transition*, p. 104 (see note 30).

125 Rosa Luxemburg Foundation, *Fast and Furious for the Future*, <https://www.rosalux.de/en/publication/id/44154/fast-and-furious-for-future> (last accessed 20 June 2023)

126 IRENA, *Geopolitics of the Energy Transition*, p. 112 (see note 30).

127 *Ibid.*, p. 113 (see note 29).

128 UNCTAD/SUC/2017/1, *Commodities and Development Report 2017*, https://unctad.org/system/files/official-document/suc2017d1_en.pdf

129 IRENA, *Geopolitics of the Energy Transition*, p. 112 (see note 30).

130 I. Huber, *Indonesia's Nickel Industrial Strategy*, CSIS, 2021, <https://www.csis.org/analysis/indonesias-nickel-industrial-strategy>

businesses.^[131] See Section 4.2. above for comment on the financial and economic added value of nickel processing in the country.

The environmental and social impacts of the nickel mining and processing have been significant. Reporting for the Transnational Institute, Rachmi Hertanti revealed how the High-Pressure Acid Leaching-based nickel smelter industry in the Pomala Industrial Park area, which was designated as a National Strategic Project (PSN) by the government, undertook land acquisition, which has in turn led to the practice of land grabbing from local farmers.^[132] In 2021, for instance, the Consortium for Agrarian Reform (KPA) recorded up to 40 agrarian conflicts due to the PSN, a number likely to increase as more mining and smelter projects are approved.^[133]

Second, in order to attract foreign investment, the Indonesian government issued a controversial national regulation, called the Omnibus Law on Job Creation, to facilitate access to business licences for foreign investors. But aspects of the law greatly undermine the country's labour rights, while the law itself is considered procedurally flawed by experts and to have been passed in an undemocratic process.^[134]

Finally, there have been severe environmental consequences. Environmental pollution around the Sorowako nickel mining and processing project has polluted local water sources, and in some cases dried them up altogether. Hexavalent chromium – a highly toxic heavy metal that is a known carcinogen and also causes liver and skin damages – has been found at levels exceeding the drinking water quality standards by the Japanese government in some areas around the project.^[135] Indonesia's nickel boom is also linked to the catastrophic biodiversity crisis underway in the country.^[136] Situated in a marine biodiversity hot spot known as the Coral Triangle, which is home to the planet's richest variety of corals, Indonesia's ore-rich islands have become the epicentre of the province's nickel industry,

131 Library of Congress, Indonesia: Export Ban on Unprocessed Minerals Comes into Effect, 23 January 2014, [https://www.loc.gov/item/global-legal-monitor/2014-01-23/indonesia-export-ban-on-unprocessed-minerals-comes-into-effect/#:~:text=Article%20Indonesia%3A%20Export%20Ban%20on%20Unprocessed%20Minerals%20Comes%20into%20Effect&text=\(Jan.,11%20at%20a%20Cabinet%20meeting](https://www.loc.gov/item/global-legal-monitor/2014-01-23/indonesia-export-ban-on-unprocessed-minerals-comes-into-effect/#:~:text=Article%20Indonesia%3A%20Export%20Ban%20on%20Unprocessed%20Minerals%20Comes%20into%20Effect&text=(Jan.,11%20at%20a%20Cabinet%20meeting)

132 Rachmi Hertanti, Between a Mineral and a Hard Place, TNI, <https://www.tni.org/en/article/between-a-mineral-and-a-hard-place>

133 Ibid.

134 Ibid.

135 Friends of the Earth Japan, Protect the Basic Human Rights of Communities Affected by the Sorowako Nickel Project in Indonesia! Submission of a Request to Sumitomo Metal Mining for Appropriate Action as an Investor and Procurer, 12 June 2023, <https://foejapan.org/en/issue/20230612/13248/>

136 Friends of the Earth Indonesia, Recognition of IPLCs Rights Is Protection of Biodiversity and Economy from Crisis, 4 May 2023, <https://en.walhi.or.id/recognition-of-iplcs-rights-is-protection-of-biodiversity-and-economy-from-crisis>

resulting in grievous damage to this important ecological zone. For example, toxic mud sediments discharged by the mines seep through the soil and are swept into surrounding waterways during the rainy seasons.^[137]

Rachmi Hertanti told the Heinrich Böll Foundation that «[t]here is no disputing the imperative for countries to develop their own local industries and not lose all the profits from their mining sector through exports. However, the state's control over natural resources and the implementation of the current national economic transformation have raised serious concerns from people and grassroots movements in the country. But the flip side to the question is, who profits the most from these policies? Is the prospect of economic growth really worth sacrificing key social and environmental rights in the short term?

«Therefore, a just transition must be constructed as systemic change through democracy in a structured manner for the people in pushing for alternative model of development based on the constitutional mandate that change more structural the model of ownership, production and consumption orientation, and control the extractions.»

Lithium processing: Argentina, Chile, DRC (planned)

«They told us that the solution was these electric cars, the salvation of the world and everything, but in reality it is not salvation. Salvation is the conscience of each human being who knows how to respect this territory as we respect it. If everyone [...] became aware of respect for the Earth, we would not have to say that electric cars are going to save the planet,» Jorge Álvarez Sandon, Coyo community, Chile's Atacama Desert.^[138]

Lithium was relatively unheard of prior to the development of green technologies.^[139] Now, the International Energy Association (IEA) says that lithium demand for clean energy technologies is growing at the fastest pace among major minerals and that lithium demand is likely to remain relatively stable. The EU predicts that its demand for lithium batteries to power EVs and energy storage is set to increase 12 times by 2030 (21 times by 2050).^[140] Lithium carbonate is currently the main chemical product used in EVs, while

137 S. Shree Raaman, «Nickel Mining Puts Indonesian Fishers on Edge», Earth Island Journal, 9 May 2023, <https://www.earthisland.org/journal/index.php/articles/entry/nickel-mining-puts-indonesian-fishers-on-edge/>

138 Sophia Boddenberg, «Chile: Lithium Exploitation Leaves Residents without Water», Deutsche Welle, 27 January 2020, <https://www.dw.com/es/chile-explotaci%C3%B3n-de-litio-deja-sin-agua-a-pobladores/a-52165228>

139 Interview by consultant, two lithium sector representatives, February 2022.

140 European Commission, Factsheet on European Critical Raw Materials Act, 16 March 2023, https://ec.europa.eu/commission/presscorner/detail/en/fs_23_1663

lithium hydroxide is expected to take its place as it is more suitable for battery cathodes with high nickel content.^[141]

Increased demand has drawn attention to which countries currently have the capability to process lithium ore into a usable chemical state.^[142] At the moment, close to 60 per cent of global lithium chemicals are produced in China (more than 80 per cent for lithium hydroxide).^[143] Lithium processing capacity is being planned in Europe: According to one market analyst, European lithium refining capacity should be able to meet European demand for refined lithium by 2030, therefore reducing processing dependency on China.^[144] In addition, some countries have already developed proprietary processes to recycle lithium-ion batteries. The key global players in lithium battery recycling include Belgium, Japan, the United States, Finland, and Germany.^[145]

Box F: How lithium processing works

Very simply put, there are two source locations for lithium ore: in brine and in hard rocks. Both require the lithium ore that comes out of the ground to undergo chemical processes.

For brine, the process involves using a lot of water together with evaporation techniques. See Figure 2. The brine evaporation technique is widely applied in South America. A 2022 report by the Natural Resources Defense Council lays out how in South America, this technique contributes to the ecological damage of internationally recognised wetlands and protected areas, where water resources are already exhausted for local and Indigenous Peoples. Many of these communities have no say in – and receive little benefit from – the mining operations.

141 IEA, The Role of Critical Minerals in Clean Energy Transitions, 2021, <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/reliable-supply-of-minerals>

142 To make lithium usable in manufacture, it is taken from the ground and refined into lithium chemicals, primarily lithium sulphate, and thereafter lithium carbonate or lithium hydroxide. Dependent on whether the lithium comes from a brine or a hard rock source, and also dependent on where it is located globally, lithium ores are either processed at or very close to mine sites (this is most often the case for lithium from brines), or the ores are shipped further afield to processing plants.

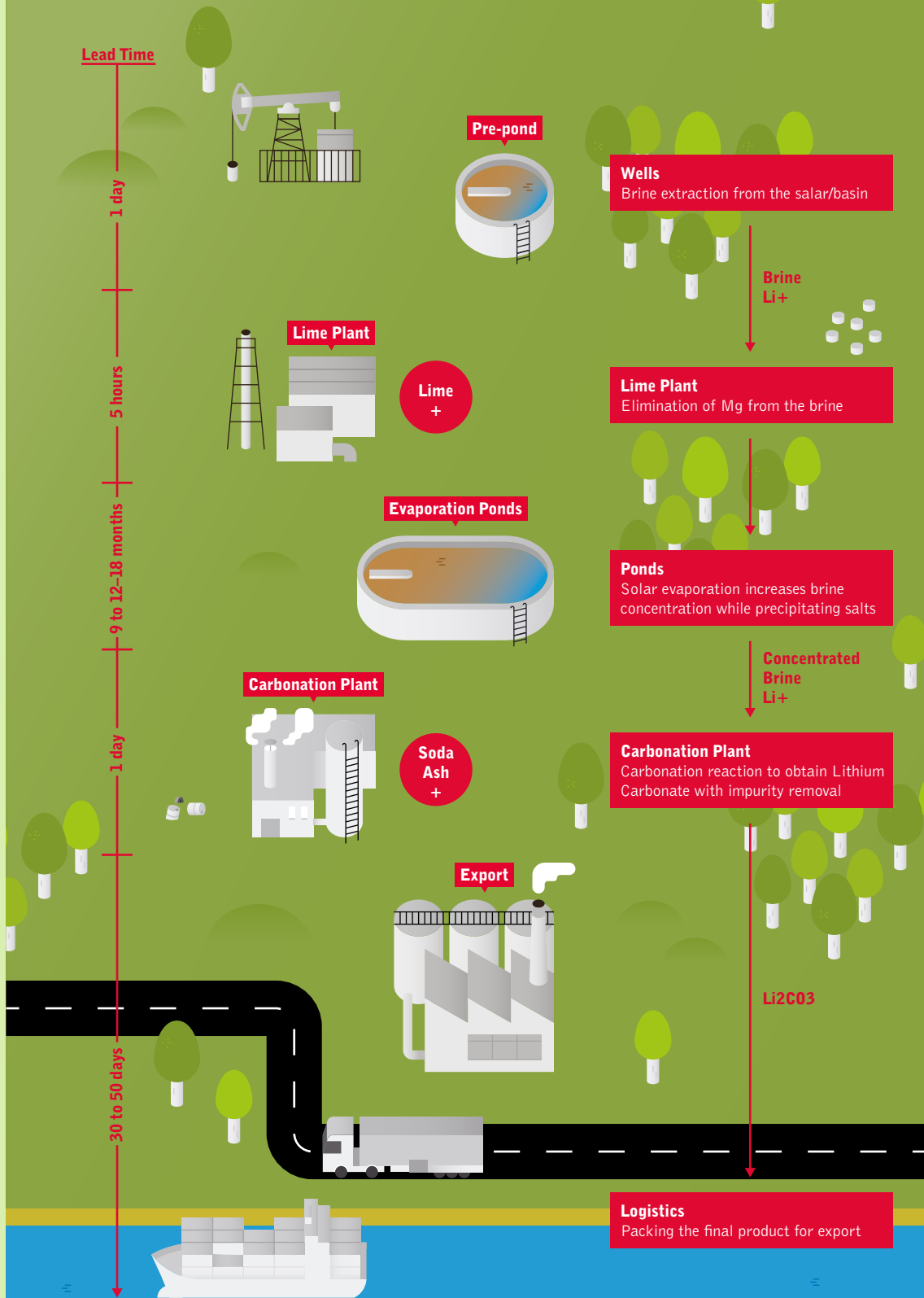
143 Benchmark Source, China's Lithium Vulnerability: Reliance on Imports Set to Rise This Decade, 29 June 2023, <https://source.benchmarkminerals.com/article/chinas-lithium-vulnerability-reliance-on-imports-set-to-rise-this-decade>

144 Jordan Roberts, Will Europe Have Enough Lithium to Meet Demand?, FastMarkets, 25 July 2023, <https://www.fastmarkets.com/insights/will-europe-have-enough-lithium-to-meet-demand>

145 Deloitte Touche Tohmatsu India LLP, Battery Ecosystem: A Global Overview, Gap Analysis in Indian context, and Way Forward for Ecosystem Development, May 2022, https://changing-transport.org/wp-content/uploads/GIZ_Battery-ecosystem-report.pdf, p. 262.

Fig. 2: Traditional process of brine extraction

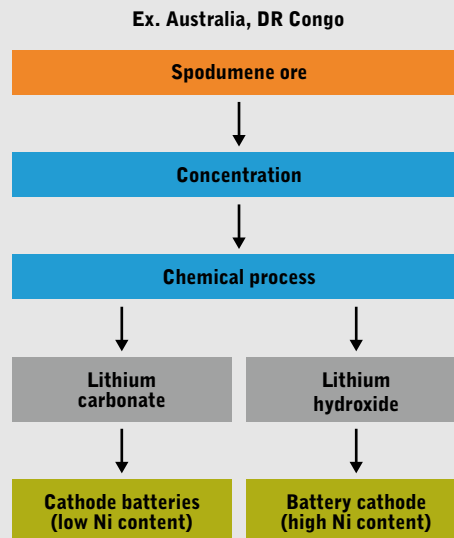
For hard rock, lithium is generally found in spodumene ores that are contained in pegmatites, such as in Australia, and can be extracted from hard rock by mining before going through a chemical process to create hydroxide or carbonate.



Source: Energy Monitor, Lithium in Argentina: How to Make It Sustainable, 14 July 2023

For hard rock, lithium is generally found in spodumene ores that are contained in pegmatites, such as in Australia, and can be extracted from hard rock by mining before going through a chemical process to create hydroxide or carbonate.

Fig. 3: Process of hard rock lithium extraction (below)



Source: IEA from 2021

Lithium processing in Argentina

The rush for lithium has already raised significant social and environmental concerns. In Argentina, lithium processing from brines – and the mining that precedes it – has been the subject of massive protests.^[146] According to reporting by Energy Monitor, the Kolla community in the Salinas Grandes salt flat lodged an official complaint with the local government against plans for lithium extraction on their land, deeming the plans a threat to their way of life.^[147] The lithium processing that goes alongside the extraction also significantly impacts human, agricultural, and livestock water supplies in the area.^[148]

146 Berta Reventós, «The Indigenous Groups Fighting against the Quest for 'White Gold'», BBC, 27 August 2023, <https://www.bbc.com/news/world-latin-america-66520097>

147 Energy Monitor, Lithium in Argentina: How to Make It Sustainable, 14 July 2023.

148 Natural Resources Defense Council, Exhausted: How Can We Stop Lithium Mining from Depleting Water Resources, Draining Wetlands, and Harming Communities in South America, 2022, <https://www.nrdc.org/sites/default/files/exhausted-lithium-mining-south-america-report.pdf>, p. 15

The planned installation of a lithium processing plant by Chinese company Zijin^[149] in Argentina's Catamarca province^[150] has also raised concerns. According to a July 2023 report from Observatorio de la Deuda en la Globalización (ODG), Zijin's Fiambalá plant, Catamarca, has created significantly higher traffic levels in the local town, as well as prompted the arrival of large numbers of Chinese personnel and hundreds of workers from other parts of the country, which has changed the social fabric of the town. The ODG report also records that in 2022, the pilot lithium processing plant was temporarily closed without any explanation. The closure coincided with a spate of poisonings among local inhabitants who had symptoms such as fever, vomiting, and muscle pain caused by contaminated water, as reported by members of the Agua Pucara Assembly.^[151] Information published in the media referred to a series of irregularities related to the handling of chemical waste, but neither the company nor the provincial authorities have provided any information about the reasons for the closure, according to ODG.^[152] The Heinrich Böll Foundation wrote to Zijin about this case but did not receive a reply.

Information transparency concerns often arise alongside environmental and social concerns around mineral processing; see the DRC lithium and Namibia copper examples below.

Lithium processing in Chile

In neighbouring Chile, lithium is extracted and processed in the Atacama Desert from salty water known as brine and drains more than 63 billion litres (16.6 billion gallons) of salty water per year in the evaporation stages of extraction alone.^[153] For the subsequent refining part of the process, companies use and contaminate freshwater, impacting a rich variety of microorganisms that grow there and nourish local species.^[154] In 2022 a National Resources Defense Council report laid out the extent of the damage being done by the companies operating in the Atacama, including to water resources. This damage stems from a failure to consult local communities under the principles of the International Labour Organization Convention 169 and the United Nations Declaration on the Rights of Indigenous Peoples.^[155]

149 Zijin, Tres Quebradas Salar, <https://www.zijinmining.com/global/program-detail-71747.htm>

150 Mining.Com, Zijin in Talks with Argentina to Turn Lithium into Battery Cathode, 11 July 2023, <https://www.mining.com/web/zijin-in-talks-with-argentina-to-turn-lithium-into-battery-cathode/>

151 Redacción Inforama, «Clausuraron una planta de litio de la empresa Liex Zijin», 3 November 2022, <https://inforama.com.ar/actualidad/2022/11/03/clausuraron-una-planta-de-litio-de-la-empresa-liex-zijin/>

152 ODG, The Mine, p. 60 (see note 32).

153 Boddenberg, «Chile» (see note 138).

154 Global Justice Ecology Project, False Solutions to Climate Change: Lithium Extraction at the Atacama Desert of Chile, 2021, <https://globaljusticeecology.org/wp-content/uploads/False-solutions-to-climate-change-Lithium-mining-in-Chile.docx.pdf>

155 Natural Resources Defense Council, Exhausted, pp. 18-19 (see note 148).

Sociedad Química y Minera de Chile (SQM) – one of the companies mining and processing lithium in the Atacama Desert and whose operations have been heavily criticised environmentally and socially by local and international observers – recently received an Initiative for Responsible Mining Assurance (IRMA) 75 audit.^[156] The audit measures the company's activities against social and environmental impact criteria.^[157] The results of the audit provide significant detail about the company's operations as observed by the auditors, who found several shortcomings. These included that although SQM had provided information to the communities on the environmental monitoring it carried out, there was still no response to communities by the company on the impacts of the company's mining operations on water and air.^[158] As noted in the preceding paragraph, the impact of lithium mining and extraction on water resources in Chile has been severe and significant. The lithium refining activities taking place at Atacama were not covered by the audit.^[159]

The Heinrich Böll Foundation wrote to SQM about this case but did not receive a reply.

An industry representative interviewed for this study that SQM's activities in Chile were considered «very good» by industry, citing as proof that the company had just achieved an IRMA 75 audit. A Chilean activist and thought leader who has worked on the issue for almost a decade strongly disagreed however, and told the author of this study that «SQM-IRMA does not cover processing plants but is actually much more problematic than that. It's a totally non-scientific approach to socio-environmental complexity that, in practice, serves only the company's greenwashing campaign that's taking place, [e]specially after the pandemic. It lacks scientific rigor: it's based on questionnaires responded to by people who depend on the mining companies such as workers, and doesn't include a representative sample of the indigenous and non-indigenous communities affected by aggregated mining activities. And it disregards scientific and state agency reports, as well as legal cases involving the company.»

Planned lithium processing in DRC

There are also environmental and social concerns that have been raised by communities in places where lithium processing and mining is being planned but has not yet begun. For example, in DRC, many members of the local community living within 5 kilometres of a planned hard rock lithium mine and processing plant in Manono – a small land-locked town in the country's copper and cobalt-rich south – felt underinformed and insufficiently

156 Natural Resources Defense Council, *Exhausted*, p. 7 (see note 148).

157 IRMA, SQM Salar de Atacama Audit Packet, September 2023, <https://responsiblemining.net/wp-content/uploads/2023/09/Packet-SQM-Salar-de-Atacama-audit-ENGLISH.pdf>

158 *Ibid.*, p. 29.

159 IRMA webinar, IRMA audit of SQM Salar de Atacama released, 7 September 2023, webinar attended by the author.

consulted by the international companies planning lithium processing and mining in their town.

According to researchers who spent almost one month in the town in April and May 2022, teachers, civil society, workers, artisanal miners, and government employees were only aware of the rumours about thousands of new jobs, a new hospital, and roads leading to major regional hubs that would stem from the mining and processing plants.^[160] They were also underinformed on what the planned mine and lithium hydroxide facility would mean for their water resources, for example.^[161] Congolese law requires that mining companies create an Environmental and Social Impact Assessment within six months of receiving an exploration permit and make a copy available to the public upon request.

At the same time, some community members protested about the lack of employment in Manono and called on the government to go further and build a lithium-ion battery factory in the town.^[162] Local Kiluba speakers used communications platforms to insist that the factory stay in Manono, rather than be located in Lubumbashi, the region's provincial hub.^[163]

According to AVZ Minerals – an Australian mining junior leading exploration work at Manono – the Manono complex would create a few hundred jobs,^[164] and the company considers it is «in full compliance with its regulatory requirements», according to its comments to New Lines magazine in September 2023.^[165] The company's 2022 annual report is unclear whether the lithium hydroxide facility would be built at Manono or elsewhere globally.^[166] The Heinrich Böll Foundation wrote to AVZ about its activities at Manono and the planned lithium hydroxide facility. AVZ told the Heinrich Böll Foundation that the company's inaugural Sustainability Report, published on the 17 June 2022, a Corporate Presentation delivered at the Battery Metals Forum on 20-21 September 2023, and a copy of an independent greenhouse gas assessment report for the life of mine of the

160 The Lithium Diaries, <https://lithiumdiaries.net/>

161 The Lithium Diaries, Voices from Manono, <https://lithiumdiaries.net/voices-from-manono.html>

162 Kiki Kienge, «Tanganyka/Kalemie : Les jeunes dans la rue contre la construction de l'usine de fabrication des batteries du lithium de Manono dans le Haut-Katanga», Kongo Press, 25 October 2022, <https://kongopress.com/2022/10/25/tanganyka-kalemie-les-jeunes-dans-la-rue-contre-la-construction-de-lusine-de-fabrication-des-batteries-du-lithium-de-manono-dans-le-haut-katanga/>

163 WhatsApp voice memo in Kiluba, shared with the author, October 2022.

164 Sophia Pickles, Jack Wolf, and Janvier Murairi, «Lithium-Abbau in Kongo: Kampf um das weiße Gold», Die Taz, 15 August 2023, <https://taz.de/Lithium-Abbau-in-Kongo/!5949987/>

165 *Janvier Murairi Bakihanaye, Sophia Pickles, and Jack Wolf*, «Green Energy in Congo», New Lines, October 2023, <https://newlinesmag.com/reportage/the-dirty-business-of-green-energy-in-congo/>

166 AVZ Minerals, 2022 Annual Report, <https://static1.squarespace.com/static/5934d2ae6b8f5beeb5ba23f3/t/617b56ad089bf75382a63004/1635473100423/29102021AVZAnnualReport.pdf>, p. 11.

Manono Lithium and Tin Project contained the company's responses. The Heinrich Böll Foundation asked for specific clarification on the detailed points it had put to the company, but it did not receive a response by the time this study was drafted.

A civil society representative said in an interview with New Lines magazine that «we have no information» about community consultation documents, however. «They haven't set out any specifications, although I read on the internet somewhere that the company intends to plant 50,000 trees.» In the absence of an Environmental and Social Impact Assessment, it is almost impossible for the local community to properly and realistically assess the risks and potential impacts of the mining project and processing plant, and whether these will be properly handled by the companies involved.

Vanadium processing in South Africa

Vanadium is a silver-grey transition metal that is abundant in the Earth's crust.^[167] Traditionally used as a steel additive to make steel alloys tougher,^[168] it has recently shot to fame as the significant ingredient in vanadium redox flow batteries, which provide long-duration energy storage.^[169] Vanadium is less written about in media articles and academic papers than some of the other CRMs. Where it is written about, however, vanadium's toxicity – which affects human health and the environment – is clear.

Box G: Uses of vanadium and where it is processed

Dependent on which way technology and the renewable energy storage market unfolds in the next five to ten years, demand for vanadium could significantly increase. Vanadium redox flow batteries are seen by some as a promising solution for medium and large storage systems required to smooth the fluctuating provision of solar and wind energy.^[170] According to the IEA, lithium demand in 2040 may be only 13 times higher if VRFBs rapidly penetrate the market.^[171]

167 Royal Society of Chemistry, Vanadium, <https://www.rsc.org/periodic-table/element/23/vanadium>

168 Ibid.

169 Samantha McGahan, «Vanadium Electrolyte: The 'Fuel' for Long-duration Energy Storage», Energy Storage News, 22 May 2023, <https://www.energy-storage.news/vanadium-electrolyte-the-fuel-for-long-duration-energy-storage/>

170 Angela Ciotola et al., «The Potential Supply Risk of Vanadium for the Renewable Energy Transition in Germany», Journal of Energy Storage, 33(2021), <https://doi.org/10.1016/j.est.2020.102094>

171 IEA, The Role of Critical Minerals in Clean Energy Transitions, 2021, <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>, Licence: CC BY 4.0 <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/mineral-requirements-for-clean-energy-transitions>

Currently there are four major exporters of vanadium oxides; Russia, South Africa, Brazil, and China.^[172] Russia provides 86 per cent of the EU's processed vanadium supply.^[173] A February 2021 US Department of Commerce report on vanadium found that it was critical to national security.^[174]

Most VRFBs use what is known as «Gen 1» vanadium electrolyte, which is a combination of vanadium pentoxide (V₂O₅), sulphuric acid, and water.^[175] The world's major producer of vanadium electrolyte is currently China.^[176] Outside of China, there are vanadium electrolyte producers in the United States and the United Kingdom,^[177] an Australian company may set up a new electrolyte processor in Australia,^[178] and *Bushveld Minerals in South Africa completed construction of an electrolyte manufacturing plant* in 2023, for which initial batches of electrolyte have already been sent to a few international customers.^[179] Bushveld Minerals owns two out of four operational primary vanadium production facilities worldwide.^[180]

Working with vanadium carries well-documented occupational hazards,^[181] and exposure can cause irregular respiration, diarrhoea, ataxia, paralysis, decreased fertility,

- 172** OECD, The Supply of Critical Raw Materials Endangered by Russia's War on Ukraine, 4 August 2022, <https://www.oecd.org/ukraine-hub/policy-responses/the-supply-of-critical-raw-materials-endangered-by-russia-s-war-on-ukraine-e01ac7be/>
- 173** Matt Birney, «EU Bank to Run Rule over Neometals Vanadium Play», Business News, 20 March 2023, <https://www.businessnews.com.au/article/EU-bank-to-run-rule-over-Neometals-vanadium-play>
- 174** US Department of Commerce Bureau of Industry and Security Office of Technology Evaluation, The Effect of Imports of Vanadium on the National Security, February 2021, <https://www.bis.doc.gov/index.php/documents/section-232-investigations/2793-vanadium-section-232-report-public-with-appendices/file>
- 175** McGahan, Vanadium Electrolyte (see note 169).
- 176** Ibid.
- 177** Ibid.
- 178** Technology Metals Australia Limited, Mou Signed With Leading Vanadium Redox Flow Battery Company, 20 May 2020, <https://www.investi.com.au/api/announcements/tmt/47d4762c-2fd.pdf>
- 179** Email correspondence with Bushveld Minerals, October 2023, and Bushveld Minerals Belco Production Facility, <https://www.bushveldminerals.com/about/operations/belco/>
- 180** Bushveld Minerals, 2019 Annual Report, p. 3 (see note 52).
- 181** W. Utembe et al., «Hazards Identified and the Need for Health Risk Assessment in the South African Mining Industry», *Human and Experimental Toxicology*, 34(12)(2015), 1212-1221, <https://journals.sagepub.com/doi/pdf/10.1177/0960327115600370>, and M. A. Woodin, Y. Liu, D. Neuberg et al., «Acute Respiratory Symptoms in Workers Exposed to Vanadium-rich Fuel-oil Ash», *American Journal of Industrial Medicine*, 37(2000), 353-363.

embryolethality, fetotoxicity, and teratogenicity in mice and rats.^[182] Availability of vanadium could become a challenge for the development of VRFBs in part due to its toxicity, health, safety, and environmental implications.^[183] The metallurgical processes used in extracting vanadium are also energy-intensive and can release toxic elements into the environment.^[184]

Vanadium processing has been relatively well studied in China. Here, the impacts of vanadium processing on the environment and communities have been significant. A 2017 academic study reported high non-carcinogenic health risks to the public in areas of Yunnan, Guizhou, Guangxi, and Sichuan provinces, where vanadium smelting and mining took place, for example.^[185] A 2020 study described serious soil contamination caused by vanadium smelting around smelters in mainland China.^[186] Another paper observed that whilst investments in vanadium and other mineral mines and processing facilities were encouraged through tax breaks and had spurred job creation in China, in some cases where environmental regulations were weak or unchecked, serious ecological, environmental, and concomitant economic impacts have occurred.^[187]

Very few studies appear to have been conducted on the hazards and risks of occupational exposure to vanadium in mines in South Africa, despite the prominent role the country plays in the global processing of the CRM.^[188] Those which have been done have focussed on the consequences of environmental exposure, particularly to livestock,^[189] and recorded mortalities when cattle ingested vanadium toxins where they were grazing,^[190] that cattle

- 182** J. Llobet and J. L. Domingo, «Acute Toxicity of Vanadium Compounds in Rats and Mice», *Toxicology Letters*, 23(1984), 53, 227-231, [https://doi.org/10.1016/0378-4274\(84\)90131-0](https://doi.org/10.1016/0378-4274(84)90131-0), and J. L. Domingo, «Vanadium: A Review of the Reproductive and Developmental Toxicity», *Reproductive Toxicology*, 10(1996), 175-182.
- 183** Ciotola et al., *The Potential Supply Risk* (see note 170).
- 184** USAID, *Mining and the Green Transition*, November 2021, https://www.land-links.org/wp-content/uploads/2021/11/Green-Energy-Minerals-Report_FINAL.pdf
- 185** Jie Yang et al., «Current Status and Associated Human Health Risk of Vanadium in Soil in China», *Chemosphere*, 171(2017), <https://doi.org/10.1016/j.chemosphere.2016.12.058>
- 186** Yi'na Li et al., «Vanadium Contamination and Associated Health Risk of Farmland Soil Near Smelters throughout China», *Environmental Pollution*, 263, Part A (2020), <https://doi.org/10.1016/j.envpol.2020.114540>
- 187** B. Tilt, «The Political Ecology of Pollution Enforcement in China: A Case from Sichuan's Rural Industrial Sector», *The China Quarterly* (2007), <https://www.cambridge.org/core/journals/china-quarterly/article/political-ecology-of-pollution-enforcement-in-china-a-case-from-sichuans-rural-industrial-sector/F65E08F9142D5FB4B349F4CD8167FAEF>
- 188** National Library of Medicine, *Environmental and Biological Monitoring in the Workplace: A 10-year South African Retrospective Analysis*, 23 July 2019, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7194147>
- 189** Utembe et al., «Hazards Identified» (see note 182).
- 190** C. M. E. McCrindle, E. Mokantlaa, & N. Duncana, «Peracute Vanadium Toxicity In Cattle Grazing Near A Vanadium Mine», *Journal of Environmental Monitoring*, (3)2001, 580-582.

retained vanadium in their tissues although this may not pose a risk to human health,^[191] and that more work is required to understand transmission of vanadium from cattle to humans.^[192] In August 2023, the United Nations Special Rapporteur on toxics and human rights said that the enforcement of laws on pollution and the release of toxins into the environment in South Africa needs to be tightened and that – although the country was advanced in terms of constitutional rights to a safe and healthy environment and has strong laws on pollution and the release of toxins into the environment – enforcement of these rights and regulations was missing.^[193]

Increased global interest in vanadium could in principle mean South Africa's vanadium processing capabilities offer an opportunity in terms of financial value addition for the country. South Africa already has a global sales network in place: In 2021, which is the year for which the latest public data is available, South Africa exported 1,645,541 kilograms of vanadium ores and hydroxides^[194] to Vietnam, 1,201,690 kilograms to the United States and 985,682 kilograms to Japan, according to UN Comtrade data. Other major export destinations were the Republic of Korea, Canada, and China.^[195]

South African President Cyril Ramaphosa has also identified partnerships borne from the just energy transition as opportunities for the country, stating that these should be country-led and owned, clear about how they define «just» – particularly with respect to social impact – and must translate into tangible financial support.^[196] The country's Just Energy Transition plan aims to harness investments in new energy technologies, EVs, and energy-efficient appliances.^[197]

Activists monitoring toxicity produced by other metal smelters in South Africa also express significant doubts. Information transparency and availability is paramount here.

191 B. Gummow et al., «The Public Health Implications of Farming Cattle in Areas with High Background Concentrations of Vanadium», *Preventive Veterinary Medicine*, 72(3-4)(2005), <https://doi.org/10.1016/j.pvetmed.2005.07.012>

192 B. Gummow et al., «A Stochastic Exposure Assessment Model to Estimate Vanadium Intake by Beef Cattle Used as Sentinels for the South African Vanadium Mining Industry», *Preventive Veterinary Medicine*, 76(3-4), <https://www.sciencedirect.com/science/article/abs/pii/S0167587706001127>

193 Alex Patrick, «SA's Dirty Air: «Perplexed» Un Special Rapporteur Calls for Better Enforcement of Pollution Laws», *News24*, 14 August 2023, <https://www.news24.com/news24/southafrica/news/sas-dirty-air-perplexed-un-special-rapporteur-calls-for-better-enforcement-of-pollution-laws-20230814>

194 HS Code 26159010.

195 UN Comtrade data.

196 Facebook, President Ramaphosa Told French President Macron That «We Are Not Beggars» at the New Global Financial PACT Summit in Paris, 24 June 2023, <https://fb.watch/InHUxH4yLh/?mibextid=xKriRt>

197 National Treasury of South Africa, Budget Speech 2023, <https://www.treasury.gov.za/documents/national%20budget/2023/speech/speech.pdf>

Eric Mokuoa, an environmental activist at the Benchmarks Foundation in South Africa, commented for this study that «value addition – I suppose this is a relative term and it depends where you are seated, especially with regard to minerals. For example, the technology that provides accurate data on emissions at these smelters is not available to the communities living by the facilities to measure emissions. The argument is often between those who have the resources [the companies] who say that they have not surpassed the [emissions] limit, and those living there who say there is a big cloud hanging over us, we are coughing. It's putting people at risk. The cost of the environment might be even too much when you add it into value addition. Whilst one would agree that there would be difference in value for non-processed and processed [minerals], the whole load of other environmental impacts has to be interrogated.»

Copper processing in Chile and Namibia

Copper is used in the manufacture of solar panels, wind farms, energy storage, and EVs^[198] and has been identified by the European Commission's Joint Research Centre as important to the defence industry.^[199]

China is the world's largest copper refiner, with around 40 per cent market share, followed by Chile, Japan, and Russia.^[200] According to the Copper Alliance, an industry body, the annual global refined copper demand is expected to double by 2050 compared to 2020.^[201] A 2022 study by KU Leuven commissioned by Eurométaux reported that demand for refined copper in Europe is expected to grow by 1 per cent annually over the period from 2020 to 2050, under a scenario in which production of decarbonisation technologies in Europe are kept at current or increasing levels.^[202]

Also according to the Copper Alliance, copper producers in the EU have made important efforts to reduce greenhouse gas emissions, including by shifting to flash smelting furnaces, installing renewable energy generation on site, and implementing energy-efficiency

198 Copper Development Association Inc, Copper and the Clean Energy Transition, undated, https://www.copper.org/resources/market_data/infographics/copper-and-the-clean-energy-transition-brochure.pdf

199 European Commission, Joint Research Centre, Raw Materials in the European Defence Industry, 2016, https://setis.ec.europa.eu/system/files/2021-02/raw_materials_in_the_european_defence_industry.pdf

200 IEA, Reliable Supply of Minerals, 2021, <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/reliable-supply-of-minerals>

201 European Copper Institute, Copper – The Pathway to Net Zero, March 2023, https://copperalliance.org/wp-content/uploads/2023/03/Copper_The-Pathway-to-Net-Zero_Focus-on-Europe_final.pdf, p. 7.

202 KU Leuven, Metals for Clean Energy, April 2022, <https://eurometaux.eu/media/20ad5yza/2022-policy-maker-summary-report-final.pdf>

measures in the mining and processing of copper. The Alliance reports that this resulted in a decrease of total emissions by 6.3 per cent over the period 1990-2018, while production volumes increased by 40 per cent, which corresponds to a reduction of approximately one-third in the carbon intensity of refined copper.^[203]

However, copper processing can still lead to unhealthy or even dangerous working conditions and environmental destruction. Two cases are included here that look at copper smelting in Chile and Namibia. Both cases highlight the tensions at play between the negative environmental and/or social impacts and the demand for job creation by mineral processing. The Namibia case is explored in greater detail because it was believed to be informative and instructive when considering added value in mineral processing.

Copper processing in Chile

In June 2023, workers protested about the loss of jobs when Chile's state-owned Codelco closed its Ventanas copper smelter^[204] in the town of Quintero, following 58 years of operations. The workers protested, even though Chile's environmental regulator had declared an environmental emergency in the region due to pollution from the smelter, which left dozens of people suffering from sulphur dioxide poisoning.^[205] Similar tensions between accepting employment from mineral processing at the cost of their own health or that of their lived environment is explored in the case study below.

A Chilean activist interviewed by the Heinrich Böll Foundation reflected that although there is a need for jobs, current mining and processing practices mean that Chile is undergoing desertification, with water-intensive mining and copper processing being part of the problem. The activist considered that Chile's copper smelting must be (re)built away from populated places and with modern technology, which the EU should ensure is a clear part of its agreement with Chile (see above on the EU-Chile Memorandum of Understanding). They added that at the moment, according to their analysis, the EU-Chile Memorandum was vague about environmental standards and commitments to technological transfer.^[206]

203 European Copper Institute, *Copper*, p. 11 (see note 201).

204 La fundición Ventanas apaga sus hornos tras 58 años de historia, Codelco, 31 May 2023, <https://www.codelco.com/la-fundicion-ventanas-apaga-sus-hornos-tras-58-anos-de-historia>

205 Mining Technology, Chile's Codelco Closes Troubled Ventanas Metal Smelter, 1 June 2023, <https://www.mining-technology.com/news/codelco-close-ventanas-smelter/>

206 The text of the agreement reads that the parties agree to «take forward» the sustainable exploitation of mineral resources «in line with internationally agreed principles and guidelines for high environmental, social and governance (ESG) standards».

Copper processing in Namibia

Mining is Namibia's leading economic sector and accounts for roughly 10 per cent of Namibia's gross domestic product every year,^[207] and the Economic Association of Namibia believed Namibia's mining sector is already producing minerals with significant value added for the country.^[208] The extent to which mineral processing could bring added economic value to Namibia is debated (see Box H).

Box H: Mineral processing in Namibia

A 2021 report by the Namibian government analysed the socio-economic impacts of Namibia's mining sector between 1990 and 2018. It found that the country's mining sector has not transitioned significantly from the extraction and export of minerals in their raw materials to increased value addition.^[209] The report noted that although mining companies had made significant corporate social investments to communities over the years, communities were of the view that more could still be done. It also recorded that most mining companies in Namibia were in foreign ownership, that minerals were processed in Namibia and exported for manufacture and use elsewhere, and that the activities of the sector had led to environmental degradation; the emissions of chemicals leading to contamination of land; noise pollution and underground vibrations; the exploitation of workers; and exposure to diseases such as asthma and cancer.^[210]

207 International Trade Administration, Namibia: Country Commercial Guide – Mining and Minerals, 3 October 2022, <https://www.trade.gov/country-commercial-guides/namibia-mining-and-minerals>

208 The report states: The following are the value additions being carried out in Namibia: DPM produces refined copper cathode, which is 99.9 per cent pure and is exported for further refining. DPM also has an acid plant, which produces sulphuric acid that is used by the local uranium mines. This has reduced the need to import sulphuric acid from international producers. Copper production in Namibia is supplemented by imports from Zambia; see Economic Association of Namibia, How Can Namibia's Mining Sector Contribute to Sustainable Development?, 2 March 2017, <https://ean.org.na/download/how-can-namibias-mining-sector-contribute-to-sustainable-development/>. The same report also states, however, that further beneficiation may be challenging, because the current and medium-term supply of domestic minerals is not sufficient to warrant the construction of capital-, water-, and power-intensive facilities, making economies of scale one of the main obstacles for further investment decisions in this sector.

209 «Value addition has been done on Gold (gold bars); Diamonds (diamond polishing and processing); Copper (copper smelting – copper cathodes); Zinc (Zinc processing leading to 99.995% pure zinc); dimension stones (processing of marbles and granites into table toppers and tiles); Coarse salt (refined salt); and Cement»; see Republic of Namibia, Office of the President, The Impact of Mining Sector to the Namibia Economy, Assessing Socio-economic and Environmental Effects, 2021, <https://www.npc.gov.na/wp-content/uploads/2022/02/The-Impact-of-Mining-sector-to-the-Namibia-economy-FINAL.pdf>

210 Ibid.

On 8 November 2022, the EU signed a Memorandum of Understanding with the Namibian government to create a partnership on sustainable raw materials value chains and renewable hydrogen, which included developing mineral refining capacity in Namibia. The agreement contends that by capitalising on its critical raw minerals, attracting investment to diversify mineral production, and increasing mineral processing and recycling activities, Namibia will create «immense benefits for Namibian citizens through job creation, skills development, technology transfer and economic diversification, thereby providing better quality of life and reducing poverty levels within our society». The EU is identified in the agreement as a key market for Namibia's processed products.^[211]

Namibia's Vice President, Nangolo Mbumba, has stated that his government is actively removing legal and administrative impediments to ensure a conducive business environment. Speaking at the US-Africa Business Summit in Gaborone, Botswana, Mbumba highlighted the country's ambitions to become a sustainable energy capital in Africa.^[212]

In the town of Tsumeb, Oshikoto region, Namibia hosts one of the few copper smelters worldwide that is capable of processing complex copper ores with high arsenic content.^[213] Owned by Canadian-based Dundee Precious Metals (DPM)^[214] since 2010 (see Box I for a history of Tsumeb),^[215] the facility at Tsumeb smelted 190,000 tonnes of concentrate in 2021, and projected a further 185,000-200,000 tonnes for 2022.^[216] According to UN Comtrade data, Namibia's highest copper exports in 2021 were to Zambia, DRC, a non-disclosed country,^[217] and Eswanti. Namibia also exported smaller amounts to the United

211 European Commission, Memorandum of Understanding on a Partnership on Sustainable Raw Materials Value Chains and Renewable Hydrogen between the European Union Represented by the European Commission and the Republic of Namibia, 8 November 2022, <https://single-market-economy.ec.europa.eu/system/files/2022-11/MoU-Namibia-batteries-hydrogen.pdf>

212 Twitter, The Brief, 13 July 2023, <https://twitter.com/TheBriefLive/status/1679569784919261187>

213 S. Lohmeier et al., «Copper Slag as a Potential Source of Critical Elements – A Case Study from Tsumeb, Namibia», 2021, Journal of the Southern African Institute of Mining and Metallurgy, 121(3), 129-142.

214 DPM, Overview, <https://www.dundeeprecious.com/English/Operating-Regions/Current-Operations/Tsumeb/Overview/default.aspx>

215 DPM, Homepage, <https://www.dundeeprecious.com/English/Home/default.aspx>

216 DPM, Overview (see note 214).

217 The partner «Areas NES (not elsewhere specified)» is used (a) for low-value trade and (b) if the partner designation was unknown to the country or if an error was made in the partner assignment. The reporting country does not send the UN details of the trading partner in these specific cases.

Kingdom, the Netherlands, Sweden, and Norway.^[218] In 2022, Namibia's top export destinations for copper were the Netherlands, China, Singapore, and Spain.^[219]

According to the company website, Dundee Precious Metals Tsumeb (Pty) Limited (DPMT), a subsidiary of DPM, is the biggest employer in Oshikoto region, employing about 800 permanent employees, of which 99 per cent are Namibians.^[220] According to 2011 census data, Oshikoto region had a population of 181,973,^[221] and its main employment areas were accommodation and food services and trade, according to a 2019/21 census.^[222] A 2021 report by the Office of the President stated that DPM drives economic development in Tsumeb and invests in the community via various projects such as infrastructure, education, and building schools and houses for employees.^[223] On 2 March 2023, DPM donated sewing machines and cooking equipment to a local centre in Tsumeb.^[224]

According to DPM's 2022 sustainability report, DPM's investment in Tsumeb has led to an economic revival, making it one of the most prosperous communities in Namibia outside of Windhoek.^[225] DPM's 2022 Environmental Management Plan for the company's consumer fuel installations states that «[t]he operations of Dundee Precious Metals as a whole has a positive impact on Tsumeb as well as Namibia as a whole by generating revenues and

218 UN Comtrade, accessed 22 September 2023.

219 UN Comtrade, accessed 22 September 2023.

220 DPM, Overview (see note 214).

221 Namibia Statistics Agency, Namibia 2011 Population and Housing Census Main Report, 2011, <https://nsa.nsa.org.na/wp-content/uploads/2021/09/Namibia-2011-Population-and-Housing-Census-Main-Report.pdf>, p. 8.

222 Namibia Statistics Agency, Census of Business Establishments Oshikoto Regional Profile, July 2022, <https://nsa.nsa.org.na/wp-content/uploads/2023/05/Oshikoto-Regional-Profile.pdf>

223 Republic of Namibia, Office of the President, The Impact of Mining Sector (see note 210). It also says: Community trust has a dedicated budget every year from which more than N\$60 million has been spent on the community, including a donation of N\$1 million towards the drought relief. They also support projects outside mining areas. DPM provides significant economic spin-offs not only to Tsumeb town but Oshikoto region at large. DPM produces and supplies sulphuric acid (one of the by-products) to Rossing uranium mine (90 per cent), and a small portion of Tschudi mine. The sulphuric acid plant serves two purposes: firstly, from a break-even perspective, secondly, as a way of eliminating the acid from the air. Dundee Precious Metals Tsumeb plans to expand their current smelter operations in Tsumeb in order to increase the copper concentrate throughput capacity from 240,000 tonnes per annum to 370,000 tonnes per annum.

224 Namibia Economist, Training at COSDEC Tsumeb Supported by DPM, 2 March 2023, <https://economist.com.na/77480/community-and-culture/training-at-cosdec-tsumeb-supported-by-dundee-precious-metals/>

225 DPM, Sustainability Report 2022, https://s27.q4cdn.com/486073686/files/doc_documents/2023/2022-Sustainability-Report.pdf, p. 23.

contributing locally to skills transfer and training which in turn develops the local workforce during operations».^[226]

Box I: History of Tsumeb

Taking a very long view and before the copper processing facility was operational at Tsumeb, construction of the railway connecting Tsumeb's first industrial copper mines – which were established under German colonial rule – with the Atlantic port of Swakopmund^[227] was linked to the *Herero and Namaqua Genocide*.^[228]

The Tsumeb copper smelter was constructed in the late 1960s to process copper from the Tsumeb copper mine.^[229] DPM took over the Tsumeb mines and processing facility in 2010 from Weatherly International plc, a UK company.^[230] DPM had begun processing high arsenic content ores from Bulgaria at Tsumeb in the years preceding the sale.

DPM began refining Bulgarian copper ores in Namibia following a severe environmental accident at the Bulgarian tailings dam of the copper smelter of Pirdop in 1988.^[231] Although copper ore deposits are usually associated with high arsenic content, the ore being mined at Chelopech in Bulgaria (and previously processed at Pirdop) has one of the highest levels of arsenic content compared to other copper deposits worldwide. Because of the high arsenic content and associated difficulties with environmental

- 226** The Environmental Management Plan also states that «the company has committed to carbon reduction measures, and has shifted some of its power needs to solar power, which it estimates will cover approximately 30 per cent of the smelter's total electricity consumption by 2024», Dundee Precious Metals Consumer Fuel Installations, Tsumeb Environmental Management Plan, March 2022, http://the-eis.com/elibrary/sites/default/files/downloads/literature/10310_EMP_Existing%20consumer%20fuel%20installations%20at%20Dundee%20Precious%20Metals_Tsumeb.pdf
- 227** Wikipedia, Otavi Mining and Railway Company, https://en.wikipedia.org/wiki/Otavi_Mining_and_Railway_Company
- 228** George Steinmetz, «The First Genocide of the 20th Century and Its Postcolonial Afterlives: Germany and the Namibian Ovaherero», *The Journal of the International Institute*, 12 (2)(2005), <https://quod.lib.umich.edu/cgi/t/text/idx/jjii/4750978.0012.201/--first-genocide-of-the-20th-century-and-its-postcolonial?rgn=main;view=fulltext#N16>
- 229** SLR Environmental Consulting (Namibia) (Pty) Ltd, Executive Summary, April 2017, https://s27.q4cdn.com/486073686/files/doc_documents/EN/DPMT_Draft_ESIA_Exec_Summ_Apr17.pdf
- 230** Weatherly International, Central Operations Executive Summary, 2013, https://minedocs.com/17/WeatherlyInternational_Description_2013.pdf
- 231** CEE Bankwatch Network, Dirty Precious Metals: Dumping European Toxic Waste in Tsumeb, Namibia, January 2016, <https://bankwatch.org/wp-content/uploads/2017/06/DirtyPreciousMetals-Namibia.pdf>, p. 10.

management, the Bulgarian government strictly prohibited this product from being further treated in Bulgaria.^[232] As a result, the high arsenic content copper ore from Bulgaria has since been transported to Namibia for processing, and the environmental and social impacts are being felt there instead of in Europe.^[233]

The arrival of the high arsenic content ores marked the beginning of more pronounced negative impacts for the community and environment at Tsumeb.^[234]

According to its 2022 Sustainability Report, DPM does not pay corporate income tax thanks to an exemption, because Tsumeb is an export processing zone enterprise and is therefore exempt from corporate income taxes in Namibia.^[235]

Negative impacts

Alongside the smelting plant's reported economic benefits, the community of Tsumeb and workers at the plant have been exposed to serious social, health, and environmental issues^[236] due to its smelting activities, however.

Scientific and health studies have found elevated levels of lead, arsenic, and cadmium in contaminated soils around the smelter, which may enter the human body through dust and eating vegetables grown on contaminated soils;^[237] that industrial emissions from the smelter contributed to ongoing exposure risk, in particular carcinogenic risks for children

232 Ibid.

233 Interviews with two members of international civil society who have worked in Tsumeb, July 2023.

234 Interviews with local civil society representative in Tsumeb and two independent experts, July 2023.

235 DPM, Sustainability Report 2022, p. 24 (*see* note 225).

236 The city of Tsumeb had been a producer of copper and zinc since 1899, until 1999 when the operation closed. During this period, the local smelter produced smoke and fumes that contained, among other elements of note, Pb, Zn, Cu, Cd, As, and Co. Upon closure in 1999, the smelter continued to process copper ores from Otjihase, Kombat, and Matchless mines. Thereafter in 2006, the smelter began to accept copper ores from beyond Namibia's borders; see B. S. Mapani et al., Results of Urine and Blood from Residents around the Copper Smelter Complex, Tsumeb, Namibia: An Example of Anthropogenic Contamination, 2011, IGCP/SIDA Project 594, Inaugural Workshop, Kitwe, Zambia, 2011, Czech Geological Survey, https://www.researchgate.net/profile/Adama-Mariko-2/publication/229112899_Overview_of_the_hydrochemistry_and_water_quality_in_areas_influenced_by_gold_mining_activities_in_West_and_South_Birrimian_of_Mali/links/0f31753c77c7fcbc3b000000/Overview-of-the-hydrochemistry-and-water-quality-in-areas-influenced-by-gold-mining-activities-in-West-and-South-Birrimian-of-Mali.pdf#page=50

237 Ibid.

(although not adults)^[238]; that the community had suffered respiratory problems from sulphur dioxide emissions resulting from the smelting process^[239]; and that exposure to baghouse^[240] dust from the smelter explained the high prevalence of irritant skin reactions among workers in Tsumeb.^[241] Community health surveys done in 2016 and 2018 found that some communities were exposed to arsenic at levels considered higher than normal, although it noted that emissions from the smelter could not account for the higher than normal levels.^[242]

A hard-hitting 2016 report from a fact-finding mission in Tsumeb by the NGO CEE Bankwatch Network recorded how hazardous arsenic waste produced at the plant was not being properly handled or stored, and that some DPM workers continued to be exposed to levels of arsenic above legal levels.^[243] A local resident described how in 2015 and 2016, «you could feel the pollution in the air. People had skin diseases ... breathing problems. The community were not happy.»^[244] A local journalist noted that, despite the revenues generated by the copper smelter, concerns about arsenic contamination in the soil had raised concerns locally about developing new and needed housing at Tsumeb.^[245]

Box J: Financing of Tsumeb

Alongside asset managers and others^[246], the European Bank for Reconstruction and Development (EBRD) is a shareholder in DPM.

- 238** Kara L. Fry et al., «Anthropogenic Contamination of Residential Environments from Smelter As, Cu, and Pb Emissions: Implications for Human Health», *Environmental Pollution* (2020), ISSN 0269-7491, <https://doi.org/10.1016/j.envpol.2020.114235>
- 239** At the moment, emission levels have declined significantly since the commissioning of the sulphuric acid plant in 2015 (as per air quality monitoring data). A significant decline is also seen in community complaints (as recorded through complaint mechanisms, from 2015 to date) and in the frequency of detection of sulphur dioxide and associated symptoms (as per community health study in 2018).
- 240** CPE Filters Inc, How Does a Baghouse Work?, <https://cpef.com/blog/how-does-a-baghouse-work/#:~:text=Baghouse%20dust%20collectors%20are%20a,being%20released%20into%20the%20atmosphere>. undated
- 241** G. P. Kew, A Study to Characterise the «Arsenic Rash» Observed at a Copper Smelter in Tsumeb, Namibia, Faculty of Health Sciences, Department of Public Health and Family Medicine, 2022, <http://hdl.handle.net/11427/37835>
- 242** Republic of Namibia, *The Impact of Mining Sector*, p. 23 (see note 209).
- 243** CEE Bankwatch Network, *Dirty Precious Metals*, p. 10 (see note 231).
- 244** Interview, local resident, July 2023.
- 245** Interview, journalist, July 2023.
- 246** Market Screener, Dundee Precious Metals Inc., last visited 9 November 2023, www.marketscreener.com/quote/stock/DUNDEE-PRECIOUS-METALS-IN-1409780/company

EBRD has provided various loans to DPM and some of its subsidiaries since 2004 and became a shareholder in DPM in 2017.^[247] In 2018 EBRD awarded DPM a Bronze award for environmental and social best practice during the annual EBRD sustainability awards.^[248]

EBRD confirmed to the Heinrich Böll Foundation that it had provided loans to DPM and was a shareholder in the company, but it noted that its equity investment supported the development of a now-operational mining project in south-eastern Bulgaria, and that this equity could not be used for any other purpose – and furthermore could not be used in Namibia, which was «not an EBRD country of operation». The Bank added that, at the time of its equity subscription, EBRD's stake in the total shares of the company was 9.99 per cent, whereas at the time of this report it was approximately 1.59 per cent.

On its website, DPM notes that EBRD reviewed and gave input on the company's 2019 Environmental and Social Impact Assessment at Tsumeb.^[249] EBRD told the Heinrich Böll Foundation that, although its equity could not be used in Namibia, nevertheless, as part of EBRD's due diligence, «all of DPM's operations were considered, including DPM's Tsumeb smelter». As such, the Bank agreed a due diligence and environmental and social action plan with DPM to «align the Tsumeb Smelter with EBRD's Environmental and Social Policy».

The action plan, which is available on the EBRD website and was established after a 2016 on-site visit by an independent consultant and EBRD, states that «additional investments» were required by DPM at Tsumeb to bring the facility in line with the EBRD's Performance Requirements, and that worker arsenic exposure – as indicated by arsenic in urine monitoring – had «decreased on average across the facility» but at that time had «not achieved the levels targeted by DPM», and that DPM would consider «offsite disposal options» for the plant's long-term disposal of arsenic waste.^[250]

However, according to analysis by CEE Bankwatch Network, EBRD did not make its involvement in the company contingent upon DPM solving the significant environmental and health issue regarding what DPM will do long term with the smelter's

247 DPM, Annual Report 2018, https://s27.q4cdn.com/486073686/files/doc_financials/English/2018/Dundee-AR-2018.pdf, p. 54.

248 DPM, Annual Report 2018, www.annualreports.com/HostedData/AnnualReportArchive/d/TSX_DPM_2018.pdf

249 DPM, Environmental Sustainability, undated, www.dundeeprecious.com/English/Operating-Regions/Current-Operations/Tsumeb/sustainability/Environmental-Responsibility/default.aspx

250 EBRD, Dundee Precious Metals Equity, last updated June 2022, www.ebrd.com/work-with-us/projects/psd/dundee-precious-metals-equity.html

hazardous arsenic waste. CEE Bankwatch Network has reported that there is no adequate solution for this waste currently.^[251]

EBRD told the Heinrich Böll Foundation that the hazardous waste facility at Tsumeb has been «approved by the Namibian Ministry of Environment and Tourism», and that DPM «has undertaken various studies, and engagement with stakeholders, on future options for the safe disposal of arsenic waste once the current facility reaches capacity». The Bank added that these included, «waste vitrification (a pilot project has been completed); establishment of a national hazardous waste disposal facility; and a new DPM hazardous waste disposal facility in Tsumeb». The Bank further added that «[a] decision on the preferred option (s) is in progress» and that «ERBD requires appropriate and safe management and disposal of hazardous waste as per its E&S Policy and is supportive of DPM's initiatives in considering various waste management solutions to replace the current on-site disposal facility.»

Regarding health impacts, EBRD pointed towards various community health studies, including a 2019 Community Health study and Health Impact Assessment, which concludes: «In summary, for the baseline situation at the current smelter throughput capacity, ambient air quality monitoring has shown continuous improvement across all measured parameters, however, an irritant burden from SO₂ emissions is still experienced periodically. Arsenic in air levels are low and are unlikely to be [sic elevated urine arsenic levels. Drinking water is also not a source of significant arsenic exposure. Soil, hand-to-mouth behaviour and eating wild plants from contaminated areas are the most likely sources of arsenic exposure.»

Finally, the Bank added that «EBRD cannot comment on interviews undertaken during 2023 in Tsumeb by Heinrich-Böll-Stiftung e.V., but can comment that significant improvements have been made at the smelter which has significantly improved local air quality.»

Four people living or working in Tsumeb told the author of the study that DPM had made improvements in recent years and that air quality in the town had improved in particular. However, a 2019 Environmental and Social Impact Assessment for Tsumeb recommended that DPM find a final solution for the disposal of hazardous waste at Tsumeb before the facility reaches capacity, and it suggested vitrification of flue dust in order to render arsenic wastes non-hazardous.^[252]

251 CEE Bankwatch Network, Raw Deal, p. 14 (see note 117).

252 SLR, ESIA Amendment Process for the Proposed Tsumeb Expansion Project, Final Environmental and Social Impact Assessment Report Tsumeb, Oshikoto Region, Namibia, June 2019, https://s27.q4cdn.com/486073686/files/doc_documents/EN/ESIA/ESIA-Report_DPMT-Expansion-Project_Public-Draft_July-2019.pdf

A subsequent 2021 CEE Bankwatch Network report (see also Box J) also notes some improvements, including the introduction of strict protocols to ensure workers do not bring arsenic dust home or out of the smelter, and experiments conducted on vitrification of the arsenic dust. However the NGO concludes that as of today, there is no adequate solution for arsenic waste.^[253] A 2020 scientific study found the same and went on the note that communities in low-income and middle-income countries are disproportionately affected by industrial pollution compared to more developed nations. It also stated that contemporary smelter operations at Tsumeb remain an ongoing health risk to the surrounding community, in spite of recent efforts to improve emissions from the operations.^[254]

In its 2022 Annual Report, DPM announced an expected reduction in higher arsenic-bearing third-party concentrate feed received by the smelter from 2024, as «the smelter is not expected to process any of Chelopech concentrate from that date».^[255] However, the report also states that «the processing of Chelopech concentrate at other third party smelters is expected to generate additional overall value for the Company».^[256] It is unclear from publicly available information where the new third-party smelters will be located, how the arsenic waste will be treated at those facilities and – critically – what will happen to the arsenic already warehoused at Tsumeb.

The DPM website says, «[t]he processing of complex concentrate at our Tsumeb smelter results in hazardous arsenic bearing dust that must be disposed of responsibly in compliance with both Namibian and international hazardous waste disposal standards.»^[257]

The Heinrich Böll Foundation wrote to DPM laying out the environmental and social concerns linked to the Tsumeb facility that are examined in this study, but it did not receive a response.

Box K: Observations from a 2021 report by the NGO CEE Bankwatch Network

«One can pretend that transferring complex copper concentrates across the world, treating them in Namibia and leaving the immense amount of arsenic waste there is a normal business practice, which ensures the metal supply needed for today's economy. But the fact is that the toxic material, which Bulgaria has forbidden to be treated on

253 CEE Bankwatch Network, Raw Deal, p. 44 (see note 117).

254 Kara L. Fry et al., «Anthropogenic Contamination» (see note 238).

255 DPM, Annual Report 2022, https://s27.q4cdn.com/486073686/files/doc_financials/2022/ar/2022-Annual-Report.pdf, p. 100.

256 Ibid.

257 DPM, Sustainability Report 2022, p. 54 (see note 225).

its territory and which most other countries do not accept, has found its dangerous storage place near the town of Tsumeb.»^[258]

In its 2021 report, CEE Bankwatch Network reported that according to Article 144 of the Namibian Constitution, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989) should automatically be applied as part of Namibian law.

The Convention is an international treaty designed to reduce the movement of hazardous waste between nations, and specifically to prevent the transfer of hazardous waste from more developed to less developed countries. It identifies waste composed of copper compounds and arsenic and arsenic compounds as hazardous waste. Furthermore, Article 95 of the Namibian Constitution states directly that: «... in particular, the Government shall provide measures against the dumping or recycling of foreign nuclear or toxic waste at Namibian territory».^[259]

The community's environmental and social problems are not limited to the impacts of the smelter's arsenic production. Most recently in December 2022, questions were raised by local media and residents about the source of a recent contamination of the town's water supply. Local media reports suggested that the water supply had become contaminated by microbiological organisms.^[260] The Namibian newspaper reported seeing an internal communication issued by DPM stating that the town's water was not fit for human consumption, following test results as part of DPM's regular monitoring using external laboratories.^[261] Namibian authorities allegedly undertook their own laboratory test but – 11 months later at the time of writing this report – the results were still unpublished.

A local businessman described how, «[in Tsumeb] [y]ou have the rich and the poor. The well-offs can buy water from the shop. But [...] it's more about the have-nots. They cannot afford water. The ordinary people don't have electricity and can't afford a loaf of bread. How will they afford to boil water before they drink. So, they have been going on drinking the [contaminated] water.»

The lack of publicly available test results about the water supply means the local population remain concerned about the quality of their water as well as about the source of the contamination. Although a study was done by the Ministry of Health, the results have not

258 CEE Bankwatch Network, *Raw Deal*, p. 44 (see note 117).

259 Ibid.

260 Ester Mbathera, «Namibia: Tsumeb Water Contamination Test Results to Be Known This Week», *AllAfrica*, 15 February 2023, <https://allafrica.com/stories/202302150258.html>

261 «Dundee Declares Tsumeb Water Unfit for Consumption», *The Namibian*, 19 December 2022, <https://www.africannewspaper.net/2022/12/19/dundee-declares-tsumeb-water-unfit-for-consumption-the-namibian/>. The article states that the company shared the results of its tests with Tsumeb's authorities.

been made publicly available.^[262] An August 2023 incident reported by New Era newspaper in which 23 DPM workers fell ill^[263] was also suspected by the population to be linked to activities at the smelter, although a local health director linked the incident to the effects of a microwave oven that DPM workers used to heat their drinks. The company's spokesperson did not respond to New Era's request for comment, according to online reporting. A local journalist underlined in reference to this study the importance of Namibia passing its Access To Information Bill.^[264] The Heinrich Böll Foundation wrote to DPM about the water contamination case at Tsumeb, but it did not receive a response.

Freedom of and access to information is critical in cases like these. During the research for this study, experts and journalists commented that people in Tsumeb appear reluctant to talk about some of the negative impacts related to activities at the smelter, because they feared for their jobs. A journalist commented that it was difficult to find people who would talk on the record, for the same reason.^[265] Another individual working in the town questioned why it had taken so long for the authorities to publish results about the contamination of the town's water supply.

In its 2015 report, the NGO CEE Bankwatch Network also raised concerns about the transparency of DPM's activities. Then the NGO found that DPM had provided insufficient information about the smelter in Tsumeb online and was unable to access this information from authorities at the smelter when requested, despite in-person visits.^[266] In 2022, another civil society organisation that attempted to visit the smelter did not receive a reply to their request from the company after they said that they were from a civil society organisation. Two people working in Tsumeb reiterated to the author of the study that it was very difficult for people working at the smelter to speak about their experiences there, because they feared for their jobs.^[267]

This situation illustrates the tensions at play when considering the added value of the jobs at the smelter to the inhabitants of Tsumeb. As one interviewee phrased it, «the value added question is generally used in Namibia and elsewhere as [being] about jobs and workplaces. Be they as dirty as possible or as few jobs as possible, [...] you can't argue

262 Interview, local journalist in Tsumeb, July 2023.

263 *Otniel Hembapu*, «Microwave Lands 23 Dundee Workers in Hospital», New Era, 23 August 2023, <https://neweralive.na/posts/microwave-lands-23-dundee-workers-in-hospital>

264 US Library of Congress, Namibia: Parliament to Consider «Access to Information Bill», <https://www.loc.gov/item/global-legal-monitor/2021-10-07/namibia-parliament-to-consider-access-to-information-bill/#:~:text=The%20bill%20would%20require%20public,prepare%20and%20publish%20information%20manuals>

265 Interview, local journalist in Tsumeb, July 2023.

266 The NGO representatives were escorted off the premises when an in-person meeting at the smelter was attempted. CEE Bankwatch Network, *Dirty Precious Metals*, p. 9 (see note 231).

267 Interview with two individuals with work in Tsumeb, July 2023.

against it. Unofficial unemployment levels are at around 50 per cent [in Namibia], mainly the youth – the students come from university and don't find a job. Many of them leave the country.»

However, it also is unclear from publicly available information about the quality of jobs on offer. For example, how many direct employees work at Tsumeb, and how many workers are contracted and therefore have different rights than direct employees. Interlocutors interviewed for this study all commented on the jobs that DPM provides to Tsumeb's inhabitants. One person noted that «DPM t-shirts are everywhere in town». Another noted that since the outbreak of the coronavirus, most of the shops in Tsumeb's shopping mall had closed down – adding to unemployment – and that there is less capital circulating in Tsumeb and less buying power, making the smelter an even more important employer.^[268]

Commenting directly on value addition and the use of new technologies by smelters, an international mining expert noted that, although new technologies give out less pollution, if the main drive is to produce **more** processed metal – even with lower emissions per volume – the overall amount of emissions will definitely increase, as noted in the company's own Environmental and Social Impact Assessment. In this regard, any increased capacity at smelters such as Tsumeb or elsewhere must go hand in hand with drastic improvements to the management of environmental and social damage.

A further question raised by the Tsumeb case study is around who holds responsibility for the impacts on the community and environment caused by the smelter. As noted above, DPM is not considered liable for environmental contamination that took place before 2010, according to the terms of its sale agreement.^[269]

In addition, DPM holds a tolling agreement with IXM SA, a Swiss-French base metal commodity trading company with headquarters in Geneva, Switzerland. The tolling agreement means that DPM makes sure it has agreed concentrate volumes available over a 12-24 month period, which it sells to IXM SA at specified toll rates.^[270] The terms of tolling agreements differ and may place, directly or indirectly, responsibility for labour practices or environmental impacts on one or the other party in the agreement.^[271] This study has not seen the tolling agreement between IXM SA and DPM to understand its terms. Agreements such as these raise questions, however, about where responsibility for

268 Interview, local businessperson Tsumeb, July 2023.

269 SLR, Appendix K, Consolidated Environmental and Social Management Plan, June 2019, http://the-eis.com/elibrary/sites/default/files/downloads/literature/511_ESMP_Smelter%20Operations%20and%20other%20related%20activities%20in%20Tsumeb.pdf

270 DPM, 2021 Fourth Quarter Report, 17 February 2022, https://s27.q4cdn.com/486073686/files/doc_financials/2021/q4/Fourth-Quarter-Report-2021.pdf

271 SmartCapitalMind, What Is a Tolling Agreement?, 26 August 2023, www.smartcapitalmind.com/what-is-a-tolling-agreement.htm

corporate activities lie. The Heinrich Böll Foundation wrote to IXM SA laying out the environmental and social concerns linked to the Tsumeb facility that are examined in this study. It also asked if IXM SA's tolling agreement with DPM established where corporate responsibility for social and environmental impacts lies, and if the company could provide details on the contents of the tolling agreement. IXM SA replied to the Heinrich Böll Foundation that «[a]fter internal discussions, [w]e have agreed to make no comment on your [...] request». A commodity expert told this study that tolling agreements such as these do not usually see the light of day.

These kinds of agreements may come under scrutiny after the passage of the EU Directive on Corporate Sustainability Due Diligence, as discussed above, given the focus that the proposed legislation places on conducting due diligence to prevent or remedy adverse impacts on human rights or the environment throughout their value chains. This could include commodity traders moving or trading processed metals from smelters and refiners to companies within the EU.

4.4. Value added: Consultation, transparency, and technological transfer

In the debate about the proposed text of the EU CRMA, international NGOs underlined the importance of a European legislation based on partnership, consultation, and approval at the highest level in producer countries, akin to the EU-Canada Comprehensive Economic and Trade Agreement, that is, forged through negotiation between equals.^[272] This includes promoting respect for the human rights of Indigenous Peoples and the rural communities in countries producing critical raw materials.^[273]

These principles apply to considerations about the value addition created by mineral processing. New agreements created within EU Strategic Partnerships that will establish metal processors in producer countries should involve consultations with communities and indigenous groups prior to agreements being signed. They should be conducted transparently so that communities can access information about projects that will affect them and understand what the added value of such projects is intended to be.

272 IPIS, *Critical Minerals and the Need for Equal Partnerships with African Producers*, March 2023, <https://ipisresearch.be/weekly-briefing/critical-minerals-and-the-need-for-equal-partnerships-with-african-producers>

273 AIDA, BHRRC, *Proposal of Amendments to the Critical Raw Materials Act of the European Union, Comments on the European Union Regulation on the Supply of Critical Minerals for Energy Transition and for Defense and Space Applications*, available on request.

Transparency matters. Currently, China and several other countries that do not implement the Extractive Industries and Transparency Initiative (EITI) control a large share of the processing of many transition minerals.^[274]

In order for mineral processors to meet the global EITI standard promoting open and accountable management of mineral resources, companies processing CRMs should provide comprehensive, disaggregated, and reliable disclosures of company payments as well as comprehensive environmental and social reporting on respecting domestic laws and the highest international standards. This will provide citizens with the information they need to understand and assess mineral processing in their communities. In addition, governments should disclose revenues from processing, in line with EITI principles.^[275]

Transparency can also protect processors against corruption. For example, in July 2023 in DRC the national government withdrew the licence of a new local gold refinery,^[276] apparently in favour of a foreign metals deal the government had established behind the scenes with a company in the UAE. Even though the refinery had received a public and official government endorsement,^[277] it was instructed to close on the evening before its official inauguration via a ministerial order sent by WhatsApp to the refinery's management.^[278] The move, which appears to have been politically motivated, contradicted the national value addition strategy – laid out by Congolese President Felix Tshisekedi – which supports the creation of domestic mineral processing.

Transparency also means that citizens can access information about the investments being made. Some metal processors may be granted tax exemptions for example, meaning that they pay nothing or a lower amount into the national treasury. This should raise questions about overall value addition to a producer country, especially if a metal producer is costing the country in terms of environmental and social impacts. For example, the Tsumeb copper smelter in Namibia operates in an export processing zone, meaning that its parent company, DPM, does not pay income tax to the Namibian government. According to the company's reports, the government wants to change this status to a special economic zone by

274 EITI, Mission Critical, November 2022, <https://eiti.org/sites/default/files/2022-10/EITI%20Mission%20Critical%20Report%202022.pdf>, p. 22.

275 EITI, Revenue Collection, <https://eiti.org/revenue-collection#:~:text=The%20EITI%20Standard%20requires%20the,extractive%20sector%20to%20the%20economy>

276 «Sud-Kivu: le ministère des Mines retire l'agrément à la société minière Congo gold raffinière», Radio Okapi, 27 July 2023, <https://www.radiookapi.net/2023/07/27/actualite/economie/sud-kivu-le-ministere-des-mines-retire-l-agrement-la-societe-miniere>

277 «RDC: vers l'ouverture d'une raffinerie d'or de Congo Gold à Bukavu», Financial Afrik, 12 June 2023, <https://www.financialafrik.com/2023/06/12/rdc-vers-louverture-dune-raffinerie-dor-de-congo-gold-a-bukavu/>

278 Interview, CGR management, August 2023.

2025. DPM pays taxes on revenues from third parties and other taxes.^[279] The Heinrich Böll Foundation wrote to DPM about this case but did not receive a response.

Transparency about a metal processor's suppliers, including beyond first-tier suppliers, is also part of the process for understanding and assessing value addition. For example, some smelters and refiners act as brokers in mineral supply chains, meaning that they receive and process minerals from a customer and send the processed metal on to a third-party buyer, without taking physical ownership of the material (or in some cases, claiming not to). This can be used as a tactic to distance a metal processor from responsibility about either the conditions in which the physical metal was sourced or traded, or the impacts that the processing of the metal has on the local community or environment.

For example, in 2020 the United Nations Group of Experts on the DRC reported that Ugandan gold refinery Metal Smelting and Testing Co. Ltd purchased smuggled raw gold from the DRC. It was then traded with PGR Gold Trading LLC in the United Arab Emirates after having been refined by Uganda-based refinery African Gold Refinery Ltd, who brokered the sales.^[280] In theory, a refinery could argue that, because it did not take physical ownership of a metal, it is not responsible for it. (Even so, in this case, African Gold Refinery and its ultimate beneficial owner, Alain Goetz, were sanctioned on 17 March 2022 by the United States,^[281] and as of 8 December 2022 also by the EU^[282] for involvement in illicit gold trading.)

The same logic applies to deals that metal processors sign with off-takers and commodity traders. These should also be transparent, available for public scrutiny, and clearly establish who bears ultimate responsibility for any negative impacts at point of extraction or processing. Establishing clear responsibility for accidents, negligence, or illegal activity is also part of assessing and ensuring value addition.

279 Interview, researcher, August 2023. In its 2021 Annual Information Form, DPM states: In December 2020, the Namibian Ministry of Finance announced that tax incentives under the EPZ Act would no longer be granted, effective 31 December 2020, and that companies with EPZ status, such as Tsumeb, would continue to benefit from these incentives up to 31 December 2025. The EPZ regime is expected to be replaced by a new regime known as the SSEZ, which is expected to be implemented in 2022, see DPM, Annual Information Form, p. 68.

280 United Nations S/2020/482, paragraph 85, <https://daccess-ods.un.org/access.nsf/Get?OpenAgent&DS=S/2020/482&Lang=E>

281 United States Department of the Treasury (2022, March 17), Treasury Sanctions Alain Goetz and a Network of Companies Involved in the Illicit Gold Trade [Press release], <https://home.treasury.gov/news/press-releases/jy0664>

282 Official Journal of the European Union (2022, December), Decisions Council Implementing Decision (CFSP) 2022/2398, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022D2398>

There are changes taking place in this respect. In recent years, binding regulations in the «home states» of corporations have emerged, for example, in Europe, with the aim of holding corporations accountable for human rights and environmental impacts overseas and throughout their supply chains – although experts observe that the extent to which such regulations contribute to enhanced «foreign corporate accountability» is not yet well understood.^[283]

Finally, the EU must prioritise technological and knowledge transfer to producer countries as part of value addition considerations, ensuring that metal processors do not use outdated technologies that are energy-inefficient and more polluting. Some new lithium smelters planned in Europe pledge to use less carbon-intensive practices, for example.^[284]

This does not appear to be happening in practice. A 30 January 2023 Memorandum of Understanding between German Aurubis AG and Codelco, reportedly as part of the German-Chilean Raw Materials Partnership,^[285] includes cooperation around smelter operations and circular economy projects in Chile, according to the company's reporting.^[286] But, although technology transfer has been discussed in the media in relation to the deal,^[287] a copy of the Memorandum has not been made public, leaving citizens in the dark about what this will mean in practice.^[288] A response to a ministerial question in Germany on the topic said that the cooperation agreement – signed on 29 January 2023 between the Federal Ministry for Economic Affairs and Climate Action and the Chilean Ministry of Mines on a German-Chilean Partnership for Mining, Raw Materials, and the Circular Economy – «strongly supports the rapid entry into force of the modernised trade agreement between the EU and Chile» but did not give further details about what «modernised» means in practice.^[289]

283 Maria-Therese Gustafsson, Almut Schilling-Vacaflor, and Andrea Lenschow, *The Politics of Supply Chain Regulations: Towards Foreign Corporate Accountability in the Area of Human Rights and the Environment?*, 30 May 2023, <https://onlinelibrary.wiley.com/doi/full/10.1111/rego.12526>

284 See, for example, descriptions on the website of Green Lithium Refining Limited, active in the United Kingdom, <https://greenlithium.co.uk/>

285 Deanne Toto, «Aurubis, Codelco Sign an MoU as Part of a Wider German-Chilean Raw Materials Partnership», *Recycling Today*, 30 January 2023, <https://www.recyclingtoday.com/news/codelco-aurubis-sign-mou-german-chilean-raw-materials-partnership/>

286 Aurubis Bulgaria, *Aurubis and Codelco Sign an Agreement to Cooperate on a More Sustainable and Responsible Copper Value Chain*, Press Release, 30 January 2023, <https://www.aurubis.com/en/bulgaria/media/press-releases/aurubis-and-codelco-sign-an-agreement-to-cooperate-on-a-more-sustainable-and-responsible-copper-value-chain>

287 Interview, Heinrich Boll Foundation with Chilean civil society, July 2023.

288 Confidential civil society interview, June 2023.

289 BMWK, *Schriftliche Fragen an die Bundesregierung*, July 2023, https://www.bmwk.de/Redaktion/DE/Parlamentarische-Anfragen/2023/07/7-114.pdf?__blob=publicationFile&v=4

Box L: Responsibility for wrongdoing along supply chains – a work in progress

In 2023, the Paris Judicial Tribunal declared a legal action brought under France's 2017 «duty of vigilance» law^[290] to be «inadmissible», arguing that Vigie Groupe SAS – formerly known as Suez Groupe SAS – could not be considered a defendant in the case, «insofar as the contested vigilance plan did not mention which precise company within the Suez Group's corporate structure was responsible for such a plan».^[291]

Another case filed against Total Energy – for «failing to comply with its legal obligations to prevent human rights abuses and environmental damage in the context of its Tilenga oil mega-project in Uganda» – was dismissed in April 2023 for similar procedural reasons.^[292] The German Supply Chain Duty of Care Act, adopted by the German Bundestag on 11 June 2021 and entering into force in 2023,^[293] although groundbreaking, has also been criticised because the law only marginally takes environmental

- 290** Note that this legislation will be superseded by the EU Corporate Sustainability Due Diligence Directive once passed. In 2017, the French National Assembly adopted a law establishing a «duty of vigilance» for large multinational firms carrying out all or part of their activity in France. Companies subject to the law (those companies that have more than 5,000 employees domestically or employ 10,000 employees or more worldwide) must now establish mechanisms to prevent human rights violations and environmental impacts throughout their chain of production, including for their subsidiaries and companies under their control. These mechanisms must be reported each year as part of a «vigilance plan»; see FRDM, The Duty of Vigilance Act, <https://www.frdm.co/france-duty-of-diligence-act>
- 291** Suez Case (Chile): Court Dismisses Legal Action – The French Duty of Vigilance Law Guttled of Its Purpose, Press Release, FIDH, 2 June 2023, <https://www.fidh.org/en/issues/litigation/litigation-against-companies/suez-case-chile-court-dismisses-legal-action-the-french-duty-of>
- 292** French Interim Civil Judge Dismisses Duty of Vigilance Case Brought by NGOs Against Total Energies, Morgan Lewis, 4 April 2023, <https://www.morganlewis.com/pubs/2023/04/french-interim-civil-judge-dismisses-duty-of-vigilance-case-brought-by-ngos-against-total-energies>
- 293** German Mandatory Human Rights Due Diligence Law Enters into Force, 27 January 2023, Business & Human Rights Resource Centre, <https://www.business-humanrights.org/en/latest-news/german-due-diligence-law/>. *The law* requires companies to identify risks of human rights violations and environmental destruction at direct suppliers and, if they gain «substantiated knowledge» of a potential abuse, also at indirect suppliers. They must take countermeasures and document them to the Federal Office for Economic Affairs and Export Control (BAFA), which can issue fines if companies violate their due diligence obligations. Affected parties can demand that BAFA take action.

aspects into account and for only considering the whole supply chain if substantiated concerns are already on the table.^[294]

The Transparency Act that entered into force in Norway on 1 July 2022 applies to larger enterprises that are based in Norway and offer goods or services in or outside Norway. The Transparency Act requires enterprises to conduct due diligence assessments, essentially transferring into law the OECD Guidelines for Multinational Enterprises.^[295]

At the EU level, on 23 February 2022, the European Commission published its proposal for a Directive on Corporate Sustainability Due Diligence, which was supported by the European Parliament in June 2023.^[296] The due diligence requirement enters into force 18 August 2025 and once passed, the EU legislation would supersede the French and German laws mentioned above. The EU legislation is intended to require companies active in the EU market to conduct due diligence to prevent or remedy adverse impacts on human rights or the environment in their value chains. The draft legislation is a welcome step towards corporate accountability. It should make it possible for companies that have caused or contributed to human rights abuses and environmental harms, such as metal processors, to be held liable in European courts.

At the same time, the EU has pioneered sustainability legislation such as the December 2022 Battery Regulation, which aims to make all batteries placed on the EU market more sustainable, circular, and safe. It has also proposed the Right of Repair Directive.^[297]

Whilst laws are being developed, over the last decade – and in part in an attempt to show that metal processors and mining companies can regulate themselves – voluntary

294 What the New Supply Chain Act Delivers – and What It Doesn't, an Analysis by Initiative Lieferkettengesetz, 11 June 2021, https://lieferkettengesetz.de/wp-content/uploads/2021/06/Initiative-Lieferkettengesetz_Analysis_What-the-new-supply-chain-act-delivers.pdf. The law limits the environmental duties to a supposedly conclusive list of three conventions ratified by Germany that are essentially aimed at protecting human health. These provide for the prevention of the use of persistent organic pollutants (POP Convention) and mercury emissions (Minamata Convention) as well as the control of transboundary movements of hazardous 4 wastes (Basel Convention). Beyond these conventions, the law covers the protected goods of soil, water, and air in the context of human rights risks.

295 Norway: Law on Mandatory Due Diligence & Right to Information about Corporate Impacts Enters into Force, Business & Human Rights Resource Centre, 15 June 2022, <https://www.business-humanrights.org/en/latest-news/norway-govt-proposes-act-regulating-corporate-supply-chain-transparency-duty-to-know--due-diligence/>

296 Arianne Griffith, «Five Wins in Our Campaign for a Law to Hold Companies to Account», Global Witness, 8 June 2023, <https://www.globalwitness.org/en/blog/five-wins-our-campaign-law-hold-companies-account/>

297 The Greens/EFA in the European Parliament (see note 107).

and often sector-specific industry standards or schemes promising «responsible» and/or «sustainable» production and trade in natural resources have mushroomed.^[298] Although the development of such schemes may sound promising, civil society has repeatedly reported how these industry standards and certifications are marked by a series of systematic, content-related, and methodological shortcomings.^[299] This has been written about extensively elsewhere.^[300] The SQM example mentioned in Section 4.3. of this study is a case in point. Policy-makers should stop turning to schemes and certificates as a means of assessing – and even guaranteeing – sustainable and responsible mineral processing and should instead ensure that this, and any added value created by mineral processing, is done by following the highest international standards and domestic legislation.

4.5. Investing in CRM processing – an investment for the future?

Discussion about value addition in CRM mineral processing faces a final challenge: «Green» refining is an emerging field, and there are relatively few standards or academic studies with which to assess best practice. In addition, although CRMs are currently touted as central to society's response to the climate crisis, experts interviewed for this study raised questions about the current CRM «rush», pointing to information gaps about their supply, creation of processing «bubbles» whereby processing capacity outstrips the volume of minerals available, and also about the inequalities that the CRM paradigm risks further entrenching.

For example, an environmental engineering expert based in Australia told the Heinrich Böll Foundation that despite the global lithium boom, very little has been published to date about best practice for lithium processing. A UK-based tantalum and lithium metals expert agreed, noting that «there is no emerging consensus on the environmental and social best practise for mineral processing», but that the advances happening are industry-focussed, for example companies working towards integrated co-dependent cooperative alliances between companies to reduce financial and geopolitical risks, rather than working on environmental or social concerns.

298 Resolve Solutions Network, World Economic Forum, Voluntary Responsible Mining Initiatives: A Review, 2015, https://www3.weforum.org/docs/Voluntary_Responsible_Mining_Initiatives_2016.pdf

299 Germanwatch, An Examination of Industry Standards in the Raw Materials Sector, 2022, https://www.germanwatch.org/sites/default/files/germanwatch_abstract_an_examination_of_industry_standards_in_the_raw_materials_sector_2022-09.pdf (last accessed 23 June 2023), p. 2.

300 The Greens/EFA in the European Parliament (see note 107).

A raw materials policy and mining expert in the DRC claimed that although there were examples of best practise where, for example, a metal processor had significantly increased exports of processed copper metal for a country, thereby increasing revenue generation, that person was unable to point to any entities conducting best environmental or social practices in their experience.^[301]

In the view of the environmental engineer, green lithium mining and refining would be based on 100 per cent renewable energy by 2025 and adopt the Initiative for Responsible Mining Assurance standard, an industry scheme, at a minimum. They added that using IRMA should help to ensure that mines and refineries are addressing water issues, tailings and waste rock management, community consent, and above all transparency.

However, the IRMA standard is also heavily criticised by civil society groups living in areas where lithium is being extracted and processed, as discussed in Section XX of this study, including for the fact that it does not assess mineral processing activities taking place at mining sites.

Another industry scheme, the Responsible Minerals Initiative (RMI), has established the Responsible Minerals Assurance Process (RMAP), which it says is used to assess to what extent smelters and refineries implement management processes for human rights due diligence and ESG (environmental, social, governance) in their supply chains, including in line with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.^[302] The RMAP has also been strongly criticised by civil society organisations, however. A 2022 study from Germanwatch, an NGO, pointed out several weaknesses in the RMAP, including that it did not assess the impacts of activities at the smelter or refiner itself, only those of the metal processor's supply chain.^[303] In a 2021 report, another NGO, Global Witness, found that between 2015 and 2018,^[304] 14 smelters and refiners (19 per cent) of 75 based in Chinese territory that the NGO analysed did not publish any due diligence information – even though 9 of the 14 entities that did not publish any due diligence information were considered «conformant» with RMI's RMAP.^[305]

301 Interview, Raw Materials Policy and Mining Expert, DRC, October 2023.

302 RMI, RMAP Assessment Introduction, <https://www.responsiblemineralsinitiative.org/responsible-minerals-assurance-process/>

303 Germanwatch, An Examination of Industry Standards in the Raw Materials Sector, 2022, https://www.germanwatch.org/sites/default/files/germanwatch_abstract_an_examination_of_industry_standards_in_the_raw_materials_sector_2022-09.pdf

304 Global Witness, Digging for Disclosure, March 2021, https://www.globalwitness.org/documents/20091/Digging_for_Disclosure_-_March_2021.pdf

305 EPRM Secretariat, RMI Responsible Minerals Assurance Process (RMAP) Documents and Tools, 30 May 2020, <https://europeanpartnership-responsibleminerals.eu/blog/view/3b545d2a-012a-4541-bf88-bc88da9a2593/rmi-responsible-minerals-assurance-process-rmap-documents-and-tools>

Civil society have consistently reported the weaknesses of industry schemes on offer for CRMs (and beyond) – including for smelters and refiners – and sometimes reporting weaknesses so significant that these undermined a scheme's efficacy altogether.^[306] As such, civil society have consistently held a position that the EU should not promote industry schemes within the EU CRMA to address raw material sourcing and supply chain problems. Instead, the EU should place the emphasis for assessing and mitigating risks or negative impacts on individual company responsibility, progressive improvement, and transparent reporting.^[307]

Tesla has claimed to have developed «innovative» lithium processing techniques for example, but it has not provided publicly available details about what this entails. In May 2023 Elon Musk broke ground at a new Tesla lithium processing facility in Texas, United States, which will produce battery-grade lithium hydroxide for use in Tesla manufacture. In its application filings held by the Texas Comptroller's office, the company claims that it will use an «innovative» process to transform the raw lithium, which is «designed to consume less hazardous reagents and create usable byproducts compared to the conventional process».^[308] On the day of the plant's opening, Tesla CEO Elon Musk claimed, «There's no toxic emissions or anything – you could live right in the middle of the refinery and not suffer any ill effects.» The company has not disclosed information on what the process will be.^[309] The company's filings to the Comptroller's office also state that the plant will create 10 new jobs, that there is a «small but undetermined possibility» that the project could impact families that relocate during construction, and that the project could generate upwards of USD 16 million in taxes for Texas, even with tax breaks applied.^[310] There is no mention of environmental impacts in the filings to the Comptroller's office. The Heinrich Böll Foundation wrote to Tesla about this case but did not receive a response.

Finally, some experts question the current rush to secure access to processed CRMs and the questions around value addition that surround it. A Bulgarian metals expert interviewed for this study said that the rush to secure processed metal is based on current demand projections, which are likely to change as technologies for the energy transition continue to

306 The Greens/EFA in the European Parliament, An Alternative Narrative on Raw Material Access, July 2023, https://www.annacavazzini.eu/wp-content/uploads/GreensEFA_Raw_Materials-v2_WEB.pdf

307 Ibid.

308 Findings of the Robstown Independent School District Board of Trustees Under the Texas Economic Development Act December 5, 2022 on the Application for Appraised Value Limitation Submitted by Tesla, Inc (Texas Taxpayer ID: #19121977292), <https://assets.comptroller.texas.gov/ch313/2100/2100-robstown-tesla-agmt.pdf>, p. 24.

309 Lora Colodny, «Elon Musk and Texas Gov. Greg Abbott Break Ground on Tesla Lithium Refinery», CNBC, 8 May 2023, <https://www.cnbc.com/2023/05/08/elon-musk-breaks-ground-on-tesla-lithium-refinery-in-texas.html>

310 Findings of the Robstown, p. 4 (see note 308).

evolve.^[311] A commodities expert also questioned the EU's response and considered it to be rather hasty. That person questioned whether deals signed in haste would not come back to bite the Union years down the line if corruption and environmental standards are not properly adhered to.^[312]

More fundamentally, a 2018 paper published by the Society of Economic Geologists pointed out that global resources and reserves of a number of critical metals as well as their production statistics remain unclear; that information quantifying the resources of critical metals is provided by the mining industry; and that other information gaps mean that significant parts of our knowledge base on the supply (and the security of this supply) of critical metals remain opaque.^[313] A 2020 study by the Oeko-Institut showed the negative environmental impacts of raw material mining and processing and argued that environmental hazard potentials should be included in the assessment of mineral criticality.^[314] Academics at FRAUD interviewed for this study said that ecological or social devastation is not foregrounded in the EU's calculations of what constitutes «critical» materials and that, as a result, criticality – as defined by the EU – is not concerned with addressing global inequalities so much as it is national economic growth.^[315] These critiques raise questions as to whether investing in processing facilities is the right decision.

311 Interview, expert, July 2023.

312 Interview, Commodities Expert, London, September 2023.

313 S. M. Jowitt et al., «The Critical Metals: An Overview and Opportunities and Concerns for the Future», Society of Economic Geologists, Inc. (SEG Special Publications), 21 (2018), 25-38.

314 On behalf of the German Environment Agency, Environmental Criticality of Raw Materials, 2020, https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2020-06-17_texte_80-2020_oekoressii_environmentalcriticality-report_.pdf

315 In detail, academics at FRAUD commented that criticality has a very specific meaning with respect to governing bodies defining strategies for the continued obtention of «critical raw materials» or «critical minerals». The EU's Critical Raw Materials Act, earlier an Initiative, began in 2008, and it contains a list of around 25 minerals deemed crucial to the union's subsistence (the latter is reviewed every few years). Criticality is calculated by taking into consideration economic importance and supply risk. Economic importance of a mineral such as titanium is mostly linked to its contribution to the country's GDP. The supply risk is largely conceived as the potential disruption of import, which could be linked to cooling international relations or war, for example. These risks are partly based on World Bank indexes of perceived nation stability, such as the World Governance Index and the Herfindahl-Hirschman Index, a formula used to assess market concentration and competitiveness. Though supply risk assessment is far more complex, the choice of which data to triangulate for this calculation begins to divulge the interests of the system of governance by which it is deployed. Ecological or social devastation is not foregrounded in these computed risks. As a result, criticality as defined in this way is not concerned with addressing global inequalities so much as it is national economic growth; see Euro-Vision, Homepage, <https://euro-vision.net/>, FRAUD (Audrey Samson and Francisco Gallardo).

Conclusions

The EU has placed an emphasis on value addition within the text of the proposed Critical Raw Materials Act and publicly available documents about its Strategic Partnerships. Building up mineral processing is part of its value addition offer. However, there is no shared, agreed understanding as to what value addition should look like within these documents, in particular in countries where mineral processing takes place.

Where there are descriptions of value addition within publicly available EU Strategic Partnership documents, these are high-level and do not provide a clear blueprint that citizens can use to understand what to expect in practice from investment in mineral processing in their country.

And while governments appear to prioritise economic value addition that is measured in increased revenues from the export of processed metals or in the numbers of jobs, citizens tend to include environmental and social health and well-being in their consideration of value addition.

Although five of the twenty-two interviewees for this study did speak about the importance of job creation, they underlined that jobs must not be created at any cost. They added that the negative impacts of mineral processing on communities, such as health impacts, may not be immediately obvious, especially when companies fail to share relevant data with communities. To reiterate the words of a South African researcher and activist interviewed for this study, «[if] there is a big cloud hanging over us, we are coughing. It's putting people at risk. The cost of the environment might be even too much when you add it into value addition.»

The findings of this study also underline the importance of free and informed consultation prior to the agreement of Strategic Partnerships or other decisions about investment in mineral processing – with communities and indigenous groups living in regions and countries where processing takes place. Without this, the very people who are supposed to benefit from the added value created by mineral processing are in the dark about what mineral processing in their country will mean in practice, and they are not given an opportunity to shape it in a way that may actually benefit them and local populations.

Of the 18 interviewees consulted for this study who lived in areas where mineral processing took place or worked on the impacts of mineral processing in those areas, all of them noted low levels or a lack of consultation with communities – either ahead of the creation of EU Strategic Partnerships that included building up mineral processing capacity, or after metal processors had already been established and were operating. Lack of consultation is particularly concerning in cases where there is already relatively little publicly available information about the impacts of mineral processing on people and the environment.

This, of course, calls for the highest levels of transparency from companies and governments, who must publish – in locally and internationally accessible forms – information about planned and actual value addition of mineral processing, including its environmental and social value. Companies and governments must spell out in concrete terms and publish the planned technological transfer to producer countries, as part of their value addition offer.

In addition, governments must remain attentive to the reality that mineral processing may not, in fact, bring economic added value. As the South Africa and Indonesia case studies included in this report show, mining and processing metals does not guarantee in-country value addition for the local populations in terms of the revenues and investments that are generated.

Finally, this study concludes that debates around value addition must remain cognisant of the reality that «green» refining – by which is meant mineral processing that does not come with negative environmental and social impacts – remains an emerging field of mineral processing at best, for which relatively few standards and studies have been developed to date, and for which best practice is scarce.

Therefore, in order to credibly claim value addition through mineral processing, the EU and the governments of producer countries must think systemically about value addition. This should encompass environmental and social metrics that create ecologically safe and socially just spaces for humanity. The EU and producer nations alike must not restrict value to economic value alone.

Otherwise, if left unreformed and without environmental and social metrics at the heart of the decisions being made, this study concludes that mineral processing will exacerbate the decarbonisation divide^[316] and worsen toxic pollution, biodiversity loss, environmental damage, and deepening social inequalities in some countries – whilst covering this up with rhetoric about economic value addition for producer countries and their citizens.

316 Sovacool et al., «The Decarbonisation Divide» (see note 25).

Policy recommendations

- The EU and its partners should develop and publish a detailed definition of value addition for mineral processing, including what this looks like within each Strategic Partnership. This must be based on prior consultations with industry stakeholders (including SMEs), the craft industry, social partners, traders, retailers, importers, environmental protection groups, consumer organisations, rights-holders, and local community representatives in third countries, particularly Indigenous Peoples and communities directly impacted by processing or any mineral-related activities/projects.
- The EU and producer countries should ensure that the value added created by mineral processing contributes towards a flourishing environment and society, and that value added specifically includes clear and measurable commitments to creating technology transfer in producer countries or those outside of the EU. Value addition should not be confined to economic measurements alone.
- Consultation alone is not enough to guarantee that communities have a say about their future. What is needed instead is the right to say «no», particularly the right to refuse extractive projects – including mineral processing projects – after having been consulted in an informed way, for the defence of the commons, and to ensure that mineral processing contributes to creating ecologically safe and socially just spaces for humanity.
- Smelters and refiners should bear responsibility for the impacts of the materials they process, even when there are tolling contracts in place or when the smelter/refiner acts as a broker.
- The EU should support the development of guidance for best practice in mineral processing. This ensures that mineral processing takes a systemic approach to the impacts of its activities, including encompassing environmental and social metrics that create ecologically safe and socially just spaces for humanity.
- The EU should decide upon an ambitious Corporate Sustainability Due Diligence directive that includes the financial sector and environmental due diligence requirements, similar to the EU-batteries regulation to facilitate better practice in processing for the EU market.

Finally, in the context of the already progressed negotiations of the EU CRMA and the concomitant reduced parameters for edits at that stage, this study comes to the following recommendations for the negotiating partners:

- The EU CRMA must uphold the European Parliament's recommendation that where Strategic Partnerships are established, the Commission must report publicly on the

economic and social developments within the partner countries of the Partnership, in particular for emerging and developing countries, while also promoting the uptake in those countries of environmentally sustainable and circular economy practices and decent working conditions as well as human rights.

- The EU CRMA must also include the following criteria in Strategic Partnerships, as recommended by the European Parliament:
 - to assess whether a cooperation between the Union and a third country (meaning a country outside of the EU) could improve a third country's ability to ensure the monitoring, prevention, and minimisation of adverse environmental impacts through its regulatory framework and the implementation thereof;
 - the use of socially responsible practices, including respect for human and labour rights, including policies to combat forced and child labour, and meaningful engagement with local communities, including Indigenous Peoples;
 - the use of transparent and responsible business practices, and the prevention of adverse impacts on the proper functioning of public administration and the rule of law;
 - and in which ways the Union can contribute through its Strategic Partnership policies, for example with vocational training and technical support, to strengthening the third countries' regulatory frameworks.
- The EU CRMA should also assess, as recommended by the European Parliament, whether a Strategic Partnership could contribute to in-country value creation as well as local value addition, including downstream activities, and whether this would be mutually beneficial for the partner country and the Union. As noted above, the definition of value creation must be shared and agreed before Partnerships can proceed.
- The EU should link any financial support for strategic projects in the context of the EU CRMA to the highest environmental and human rights requirements and not rely solely on certification schemes.

Annex: Summary of interviewees

Australia (environmental engineering expert, NGOs)

Bulgaria (international mining expert, academics)

Chile (NGOs)

DRC (private sector, raw materials policy and mining expert, civil society living in processing region)

Germany (NGOs)

Ghana (NGO)

Indonesia (NGOs, journalist, civil society living in processing regions)

Namibia (local journalist, private sector, civil society living in processing region)

South Africa (NGOs, civil society living in or working on processing regions)

United Kingdom (mineral processing expert, academics, commodities expert, mineral trader)

United States (NGOs)

About the author

Sophia Pickles endeavours to be an active listener. For the last fifteen years she has investigated supply chains and specialises in research on natural resource extraction, trade and its impacts. Sophia is a published author on human and environmental rights. Between 2019 and 2022 she participated in a United Nations Expert Group on the Democratic Republic of Congo as Natural Resources and Finance expert, reporting to the UN Security Council.

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