MINING, RECYCLING AND TRUST

CHANCES AND CHALLENGES FOR A RESILIENT EU BATTERY SUPPLY CHAIN

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Authors: Esther Laabs (WWF Germany)
Katalina Engel (Engel Consulting)

Co-Authors: Stefanie Degreif (Oeko-Institut)
Johannes Klinge (Oeko-Institut)
Pano Fotiadis (University of Toronto)

Design: Wolfram Egert

FOREWORD

In an era defined by the imperative to build a climate-neutral economy, Europe stands at a pivotal crossroads – one that demands unflinching honesty about what the green transition actually requires. Clean technologies are not materialless technologies. Electric vehicles, stationary battery storage, and the broader architecture of decarbonisation all depend on a steady, secure, and responsibly sourced supply of strategic raw materials: lithium, cobalt, manganese, graphite, and more. As the EU accelerates its decarbonisation agenda under the Green Deal, the question of where and how these materials are obtained has moved from a niche industrial concern to one of the defining policy challenges of our time.

This report takes a rigorous and candid look at what it will genuinely take for Europe to meet its battery material needs. It examines extraction, recycling, and governance in tandem – because no single lever will be sufficient on its own, and no honest assessment can afford to consider them in isolation.

On the mining side, the picture is sobering. While Europe holds real geological potential for strategic battery minerals, the gap between potential and reality remains wide. Many deposits sit in or near protected areas and water-stressed regions, raising fundamental questions about whether the CRMA's extraction benchmarks are achievable – or even desirable – within the timeframes envisaged.

Recycling offers a more promising and more sustainable path forward. Europe's lithium-ion battery recycling capacity is expanding, and the long-term numbers are striking: by 2040, secondary supply could cover up to 68 % of EU battery demand, potentially displanting the need for over a dozen new mines globally. Yet this potential will only materialise if Europe invests urgently in recycling infrastructure, adapts technologies for newer battery chemistries such as lithium iron phosphate (LFP), and builds robust collection systems.

Neither mining nor recycling can succeed without the trust of the communities they affect. Social licence to operate is not a box to tick – it is a dynamic, ongoing relationship between industry, government, and the public. The contrast between projects that have failed due to secrecy and community exclusion, and those that have succeeded through genuine participation and benefit-sharing, is stark and instructive. Europe's dense civil societies and active local governance make public acceptance a genuine make-or-break factor, not an afterthought.

Underpinning all of this is a legal and governance framework that is under pressure. The EU's environmental acquis remains comparatively strong, but risks erosion through simplification agendas and fast-track permitting if policymakers are not vigilant. The CRMA must not become a vehicle for weakening the environmental safeguards and due diligence obligations that give Europe's industrial ambitions their legitimacy.

This report does not argue against the energy transition – quite the opposite. It argues that the transition can and must be done right: with circularity and recycling at its centre, environmental protections intact, and communities as genuine partners rather than obstacles. A resilient, just, and sustainable EU battery value chain is within reach. But only if the right choices are made now, with clarity of purpose and the courage to uphold the standards that Europe rightly demands of itself.

The insights and recommendations that follow serve as a call to action for policy-makers, industry stakeholders, and citizens alike. The path to a best-in-class battery value chain requires a harmonious blend of technological ambition, stringent regulation, and an unwavering commitment to sustainability. This report is offered as a contribution to that essential endeavour.

Bibiana Garcia
Global Lead
Metals & Mining
WWF Germany

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ABBREVIATIONS

CRMA	Critical Raw Materials Act
CSDDD	Corporate Sustainability Due Diligence Directive
BESS	Battery Energy Stationary Storage
BEV	Battery Electric Vehicles
EIA	Environmental Impact Assessment
EoL	End of life
EU	European Union
GHG	Greenhouse Gas
GWh	Gigawatt hours
IED	Industrial Emissions Directive
kt/a	kilo tons/ ano
kWh	kilo Watt hour
LFP	Lithium Iron Phosphate
LIB	Lithium Ion Battery
NCA	Lithium Nickel Cobalt Aluminium Oxide
NECD	National Emission Reduction Commitments Directive
NMC	Lithium Nickel Manganese Cobalt Oxide
NZIA	Net Zero Industry Act
R&D	Research & Development
SIA	Social Impact Assessment
SLO	Social License to Operate
T&E	Transport & Environment
WFD	Water Framework Directive

EXECUTIVE SUMMARY

This report assesses how the EU can secure critical raw materials for battery electric vehicle and battery stationary storage through a combined strategy of mining, recycling, and social license to operate (SLO), while remaining aligned with environmental and social safeguards.

The report builds on previous WWF work on the Critical Raw Materials Act (CRMA) and the Net Zero Industry Act, zooming in on extraction and recycling of lithium-ion battery (LIB) raw materials in Europe. It aims to quantify EU mining and recycling potential for key battery materials, assess whether CRMA and Battery Regulation targets can realistically be met, and explore environmental, social, and SLO implications of expanding these activities.

Mining outlook and constraints

LIBs are expected to remain the dominant battery technology at least to 2030, with a strong shift from NMC/NCA to LFP chemistries, driving a steep rise in lithium and phosphate demand and a relative decline in cobalt. Europe holds geological potential for all strategic battery minerals, but currently only nickel is extracted at meaningful battery grade volumes, while lithium, cobalt, manganese and graphite mining either do not serve LIBs or are at pilot/early project stages. Even under optimistic assumptions on confirmed projects, most 2030 CRMA extraction benchmarks are only met on paper, with major uncertainties around capacities, lead times of 10–18 years, and strong conflicts where deposits overlap with protected or water-stressed areas.

Recycling potential and gaps

LIB recycling capacity in Europe is expanding rapidly, organized in spoke and hub systems and moving from pyrometallurgical to more hydrometallurgical and hybrid routes to improve material recovery and reduce impacts. End-of-life BEV and BESS batteries remain scarce this decade, but by 2030–2040 secondary supply could cover 14–40 % of EU BEV/BESS demand (rising to 24–68 % by 2040), with recycling able to avoid the equivalent of around a dozen new global mines if fully realized. Overall, the report sees substantial long-term potential from secondary sources but warns that realization hinges on rapid deployment of recycling hubs, improved technologies for LFP and graphite, and robust collection networks under extended producer responsibility.

Environmental, social and legal risks

Mining of transition minerals entails significant impacts on landscapes, biodiversity, water resources, climate, and local communities, often persisting long after closure, with many EU occurrences located in or near protected and water-stressed areas. While battery recycling generally performs better than primary mining in terms of greenhouse gas emissions, land use and pollution, its own footprint – especially energy use, CO_2 emissions, toxic releases and occupational health risks – remains nontrivial and technology-dependent. The EU's environmental acquis (Industrial Emissions, Extractive Waste, Water Framework, Habitats and Birds Directives, etc.) provides a comparatively strong framework, but is fragmented for mining, outdated in parts, and now under pressure from CRMA "public interest" provisions and the Omnibus simplification agenda. The report warns that strategic project status and shortened permitting could weaken environmental and social safeguards if not corrected.

Social license to operate and governance

Given Europe's high population density and active civil society, public acceptance emerges as a core bottleneck for both mining and recycling projects. Case studies such as Rio Tinto's Jadar lithium project in Serbia and recycling projects in Germany illustrate how inadequate, top-down engagement, transparency gaps, and perceived disregard for local concerns can lead to protests, stalled permits, and project freezes with systemwide repercussions.

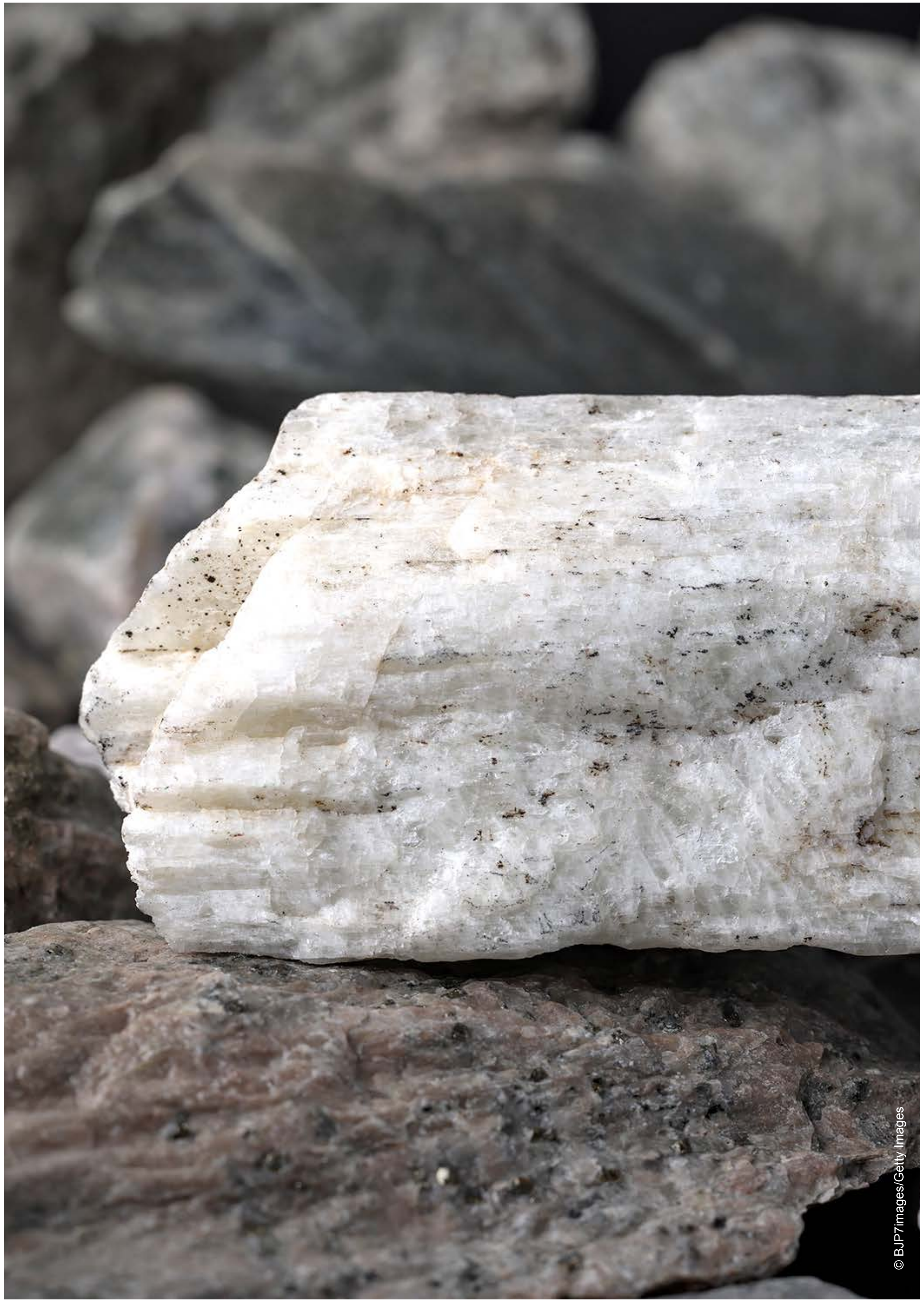
Conversely, examples from Finland, Sweden, Spain and German mining projects and recycling facilities show that early, participatory engagement, transparent communication, benefit-sharing, and integration into local development strategies can build durable SLO and even spur regulatory improvements. The report frames SLO as a dynamic, revocable social contract that requires companies to go beyond legal compliance, and calls for EU-level SLO guidelines, monitoring and mandatory social impact assessment (SIA) for strategic projects.

Key conclusions and recommendations

The report argues that EU raw materials policy remains overly extraction-centric, as reflected in CRMA strategic project selection (15 extraction vs. only 7 recycling projects), despite clear environmental and strategic advantages of recycling and circular economy measures. It recommends:

- Rebalancing financial and regulatory support in line with a mitigation hierarchy of avoid, repurpose, reuse, repair, remanufacturing, recycle and second life applications.
- Reforming and strengthening EU legislation, including updating the Mining Waste Directive, ensuring CRMA strategic status cannot override core environmental directives, and resisting dilution of corporate due diligence frameworks.
- Embedding SLO from project inception via mandatory SIA, meaningful civil-society participation, FPIC for Indigenous and other rights holders, clear grievance mechanisms, and adherence to OECD and EU due diligence standards across supply chains.
- Addressing underlying drivers of demand by promoting sufficiency (smaller vehicles and batteries, modal shift to public transport) and stricter product lifetime and EPR requirements.

Overall, the report concludes that a resilient and just EU battery value chain is technically achievable if recycling and circular strategies are prioritized, legal safeguards are reinforced rather than weakened, and SLO becomes a central governance criterion rather than an afterthought.



1.0 BACKGROUND AND AIM OF THE REPORT

This analysis can be seen in the context of a larger project commissioned by WWF on the battery value chain in Europe and funded by the European Climate Foundation (ECF). In 2024, WWF published a report exploring the environmental and climate implications of achieving the benchmarks outlined in the European Union's Critical Raw Materials Act (EU CRMA) and the Net Zero Industry Act (NZIA), focusing on processing raw materials within the EU for increasing battery manufacturing on European soil. This report builds on the previous one, focusing on battery mineral extraction and recycling in Europe[1]. The analysis for this part of the project was done by Oeko-Institut and the compilation process of data collection and conducting interviews started in late 2024. The collected data had to be adjusted numerous times by the time of publication due to various reasons. One of them being the lack of a comprehensive database for planned mining projects in the EU. Therefore, information needed to be gathered from different public resources. Similarly, this applies to the data available on the negative environmental impacts of mining activities in Europe. As there was no sufficient data available for certain raw materials, environmental impacts were addressed from a global rather than European perspective. Recycling projects continue to be planned, postponed, and cancelled at high speed. The European Commission's review of its sustainability regulations under the Omnibus simplification package started in 2025 and is ongoing. Great care has been taken to present data as recent and complete as possible by the publication deadline in March 2026. However, readers should be mindful of possible further changes in the meantime.

The first part of this report sets the scene by giving an overview of the demand of primary raw materials needed for different battery types (focus is laid on batteries for electric vehicles (BEVs) and battery stationary energy storage (BESS)), their availability in Europe, and an overview of existing and planned mining projects in Europe (Chapter 2). The second part gives an overview of the actual capacities of battery recycling in Europe by exploring the EU's current and projected future recycling potential (Chapter 3). The third section looks at the environmental impacts of mining and recycling and summarises the European environmental and social legislation in place that affects mining and recycling activities in Europe (Chapter 4). The fourth section highlights the implications for mining and recycling companies regarding their SLO, and how it can be achieved and maintained (Chapter 5). The final section discusses the outcomes of chapters 2–5 and outlines recommendations for policy and industry (Chapter 6).

1.1 The Critical Raw Materials Act

The decarbonisation of economies on a global level, including energy and transport systems, is driving an unprecedented global increase in demand for transition raw materials needed for generating electricity from solar and wind energy, or for mobile and stationary energy storage in batteries. This presents the EU with a number of challenges, as it is highly dependent on third countries to provide key battery and energy transition materials. To counteract this dependency, in May 2024, the EU adopted the CRMA (European Parliament 2024).

According to the CRMA, the EU aims to strengthen the European raw materials sector and achieve resilient value chains by ensuring that of the EU's annual consumption of transition materials, at least 10 % are extracted, at least 40% are processed and at least 25 % are recycled in Europe. At the same time, the new EU Battery Regulation sets minimum thresholds for recycled material content for batteries entering the EU market and specifies recovery rates for certain metals (European Parliament 2023b). To meet the demand and fulfil the targets set by the CRMA and the new Batteries Regulation both the EU's extraction and recycling capacities require significant boosting within a short timeframe.

To reach the benchmarks set by the CRMA by 2030, strategically planned mining and recycling projects

1) The CRMA sets benchmarks for minerals extraction, processing and recycling, therefore this report does not focus on the value chain step of battery production.

must be implemented soon. On the one hand, this will require secure financing, while on the other hand, permitting timeframes need to be shortened significantly to reach the CRMA benchmarks.

To be able to increase the availability of strategic materials within the EU within a short timeframe, in March 2025, the European Commission approved 47 strategic projects across 12 EU Member States. These will benefit from reduced administrative burden and streamlined permitting procedures. The act aims to reduce the EU mining permitting process to less than 3 years (27 months for extraction projects and 15 months for processing, recycling and substitution projects (European Commission 2024a), from an average of 10–15 years today (OECD 2025). In addition, selected strategic projects can get support for access to finance. 23 of the 47 projects comprise extraction activities (of which 9 for lithium, 3 for nickel and cobalt, and 2 for graphite, 1 for manganese) (European Commission 2025b). The European Commission expects the selected strategic projects to meet 80% of the extraction demand in the EU for lithium, 44% for nickel and cobalt, 8% for manganese, and 8% for graphite (see factsheets at European Commission 2025c). Map 1 shows where the extracting and recycling strategic projects related to battery grade raw materials are located in Europe (see Annex I for a complete list of strategic projects under the CRMA, as of January 2026). In January 2026, the second call for applications for strategic projects closed and is currently in the selection process (European Commission 2026).

1.2 Civil Society Organizations' concerns over CRMA Strategic Projects

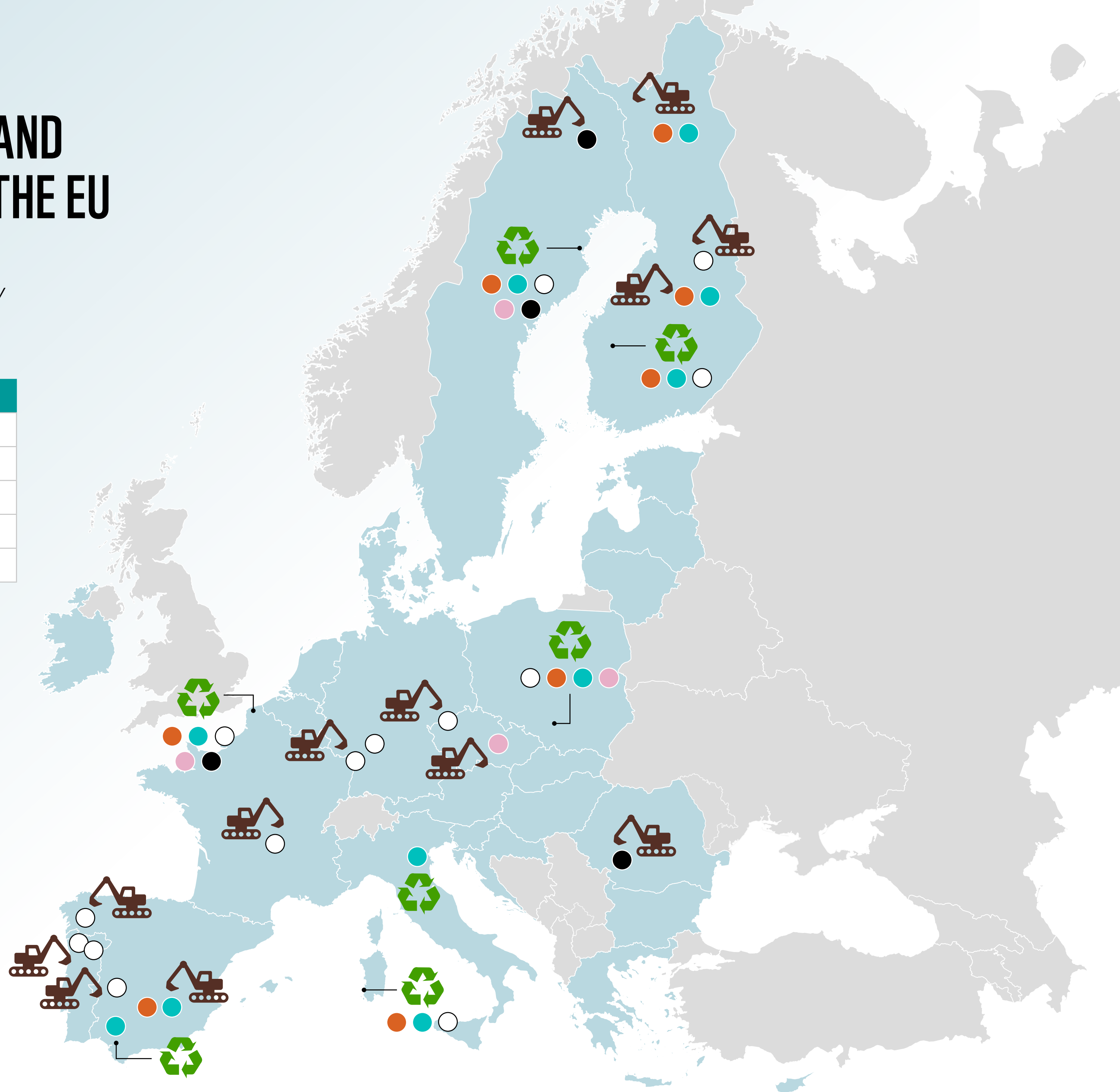
Whilst the selected projects and associated administrative measures are expedient from a strategic perspective to strengthen the EU's economic resilience, their implementation raises several concerns from European Civil Society organisations. WWF, along with other civil society organisations, disapproves of the intransparency of the selection process of the strategic projects, particularly regarding extraction undertakings (ClientEarth 2025, EEB 2025). While there was a call for experts to support the Commission in the selection process, the CRMA itself does not encourage formal involvement of civil society, Indigenous peoples, and

STRATEGIC EXTRACTION AND RECYCLING PROJECTS IN THE EU

Locations of the 22 strategic projects focusing on extraction and recycling (out of a total of 47 selected projects) of battery raw materials under the CRMA.

(Source European Commission 2025b)

Acronym	Element
Co	Cobalt
C	Graphite
Li	Lithium
Mn	Manganese
Ni	Nickel



impacted local communities in the selection process (CRMA, Art. 6) (European Parliament 2024). WWF also expresses concerns about the “public interest” status of the CRMA strategic projects. According to the EU Habitats Directive, a project can only be approved in a protected area if no alternatives have been identified following a negative impact assessment, and if the project must be carried out “for compelling reasons of overriding public interest, including those of a social or economic nature” (European Communities 1992). Civil society organisations also fear that permits for production sites may be issued in a rush without rigorous and ambitious environmental or social impact assessments (EIA and SIA) being carried out before approval.

For much of Europe’s population, mining is synonymous with coal extraction, which has a reputation of poor working conditions and negative health and environmental impacts (Kivinen et al. 2020). There is thus a general reluctance of local populations to see new projects go live or old projects be re-opened. Increasing the EU’s capacities of mining and recycling will therefore hinge on securing the acceptance of communities and society as whole, and especially on the acceptance of communities living near the projects. This acceptance is conceptualised as social license to operate (SLO) (Breakey et al. 2025).

1.3 The Life Cycle of Lithium-Ion Batteries

Figure 1 shows the typical life cycle for Lithium-Ion Batteries (LIBs) in BEV and BESS applications. The life cycle begins with raw material sourcing (either mining of primary raw materials or through recycling of End-of-Life LIB´s), followed by materials processing, component manufacturing, cell manufacturing, and afterwards module and/or pack assembly. Finished battery packs are placed in vehicles or used for stationary energy storage applications. After their first use phase, batteries may enter a second life phase for stationary energy storage, for example. At the end of their life, batteries are recycled to recover valuable materials to be reused for new battery production.

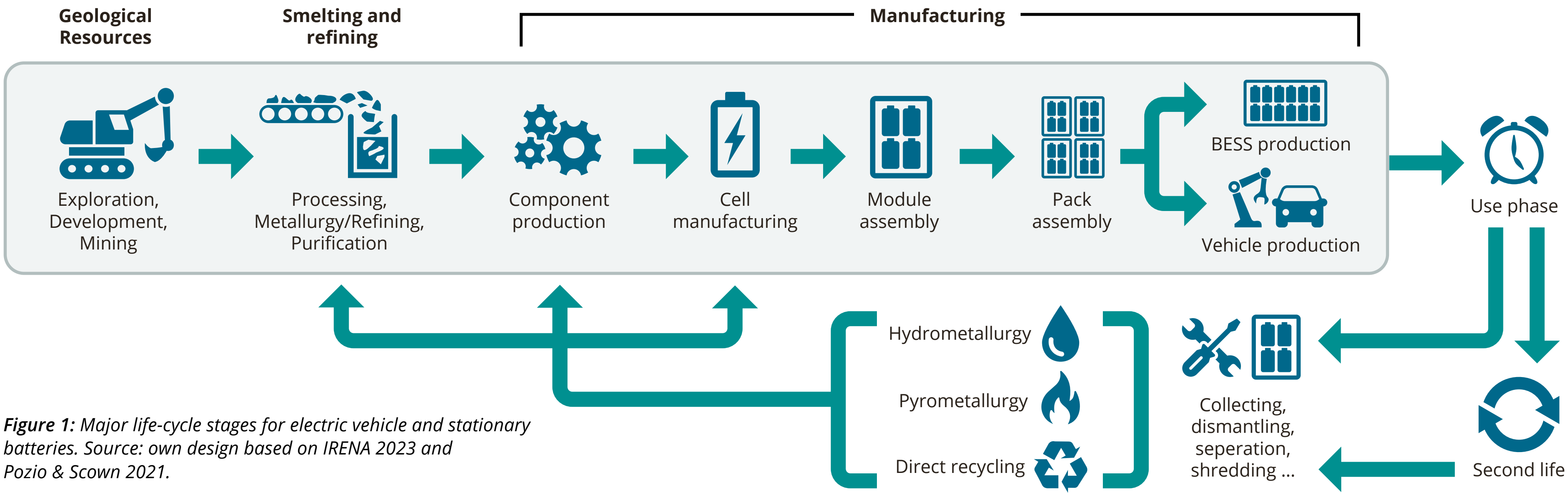


__Figure 1:__ Major life-cycle stages for electric vehicle and stationary batteries. Source: own design based on IRENA 2023 and Pozio & Scown 2021.

2.0 MINING IN THE EU

2.1 Demand of primary raw materials for different battery chemistries

LIBs are projected to remain the dominant battery chemistry until at least 2030. The raw materials needed for their production vary depending on the specific battery chemistry and their design.

Anode materials vary little between different LIB chemistries, most of them being dependent on graphite. While lithium-nickel-manganese-cobalt oxide (NMC) and lithium-nickel-cobalt-aluminium oxide (NCA) battery cathode chemistries depend hugely on the availability of cobalt and nickel for cathodes, two raw materials marked by high prices and price fluctuations and surrounded by ethical mining concerns, lithium iron phosphate (LFP) batteries do not contain these raw materials.

Future market shares of different battery chemistries and associated strategic material demand are difficult to predict with precision, since the market is constantly evolving due to rapid technology advances. According to a WWF projection, by 2030, LFP chemistries are expected to experience a 17-fold increase in demand and replace NMC as the market leader (see fig 2) (WWF 2024). Subsequently, mineral demand for these chemistries is expected to grow up to 7-fold (see fig 3). The amount of strategic materials needed for an LIB varies depending on the battery chemistry and its size. A "typical" BEV with a 60-kWh NMC 622 battery requires about 6 kg of lithium, 32 kg of nickel, 11 kg of cobalt and 10 kg of manganese (T&E 2021).

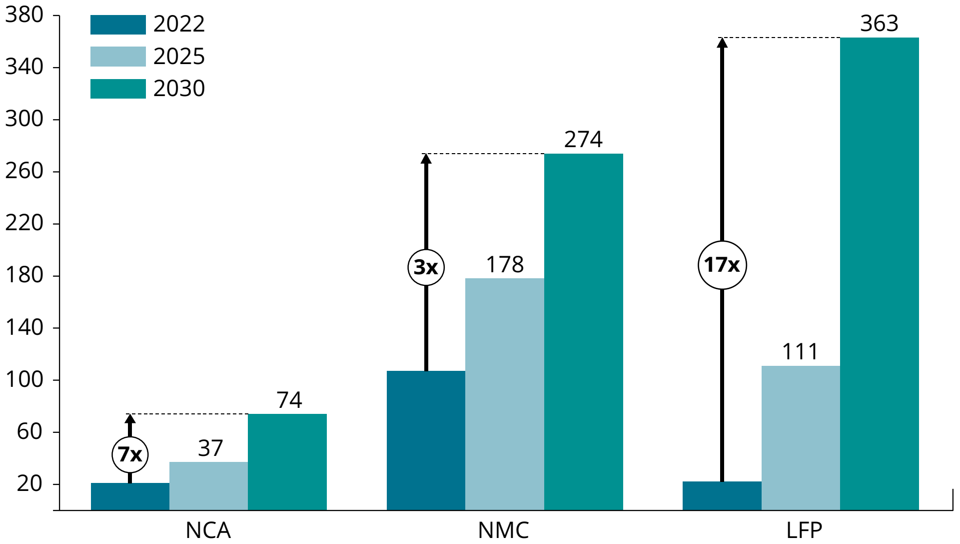


Figure 2: Projected annual demand for different battery cathode chemistries (GWh) in the EU by 2030. Source: WWF 2024.

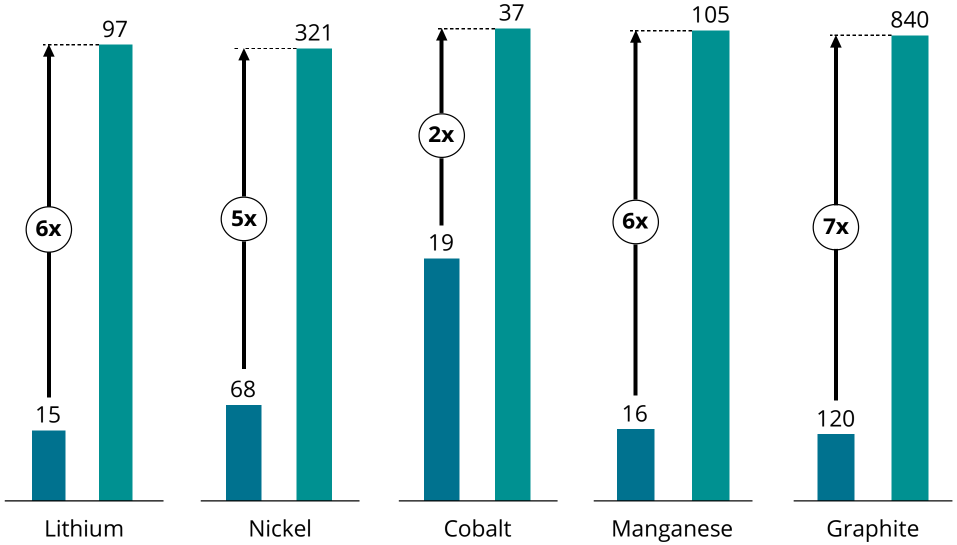


Figure 3: *Projected material demand for batteries in the EU by 2030 (kt). 2022 2030 Source: WWF 2024.*

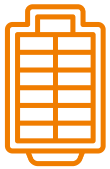
2.2 Availability of primary raw materials for battery production in the EU

In principle, Europe has reserves of all strategic materials to produce LIBs (i.e., lithium, nickel, cobalt, manganese and natural graphite). Apart from the list of strategic projects, information on existing and especially about planned mining projects is scarce and scattered. Furthermore, concrete data on planned capacities (kt/a) is often not available, not even for the strategic projects under the CRMA.

Based on desktop research, table 1 provides an overview of existing confirmed and unconfirmed planned battery mineral extraction projects in the EU for projected battery production in 2030, including the strategic projects under CRMA, for those projects where data was publicly available.

Of these, only nickel is currently mined in Europe in quantities and qualities suitable for battery production, as economically viable and well-developed deposits exist. Currently, lithium is being mined in Portugal for use in the ceramics industry, while graphite mined in several EU countries is not used for LIBs. Additionally, cobalt is mined at a small scale and manganese is currently not being mined in the EU.

Mining projects for most of these transition materials, except manganese, are being explored or planned or are in the phase of licensing to start operations. Given that, besides nickel and cobalt, there are currently no active mining operations for strategic battery minerals within the EU, existing mining explorations within the EU must be intensified and new mining projects fast-tracked to meet the CRMA targets for all battery materials.



A "TYPICAL" BATTERY
REQUIRES 6 KG OF LITHIUM, 32 KG OF NICKEL, 11 KG OF COBALT AND 10 KG OF MANGANESE

Mineral	Projected demand by 2030 (kt/a)	Current EU extraction capacity (kt/a)	Planned/ predicted EU extraction capacity by 2030 (kt/a)		Predicted shortfall (confirmed projects) 2030 (kt/a)	10% CRMA extraction objective met?
			confirmed projects	In exploration/not confirmed		
Lithium	97	0	177,5	0	0	Yes
Nickel	321	41,3	41,31*	21,47	279,69	Yes
Cobalt	37	1,70	3,50	0,26	33,50	Yes
Manganese	105	0	no information	no information	105	No
Graphite	840	0,1	120,1	no information	719,9	Yes

** The planned capacity of mined nickel is the same as the current because there is no data available on confirmed planned capacities for nickel in the EU.*

Table 1: *Overview of existing and planned battery material mineral extraction projects in the EU for projected battery production in 2030. Source: desktop research[2], last update September 2025[3].*

2) See Appendix II for detailed information on mining projects in Europe.

3) The listed unconfirmed projects and also the strategic projects under the CRMA are potential projects that are still uncertain. They depend highly on economic feasibility and practical operability.

2.3 Challenges and new opportunities for mining in the EU

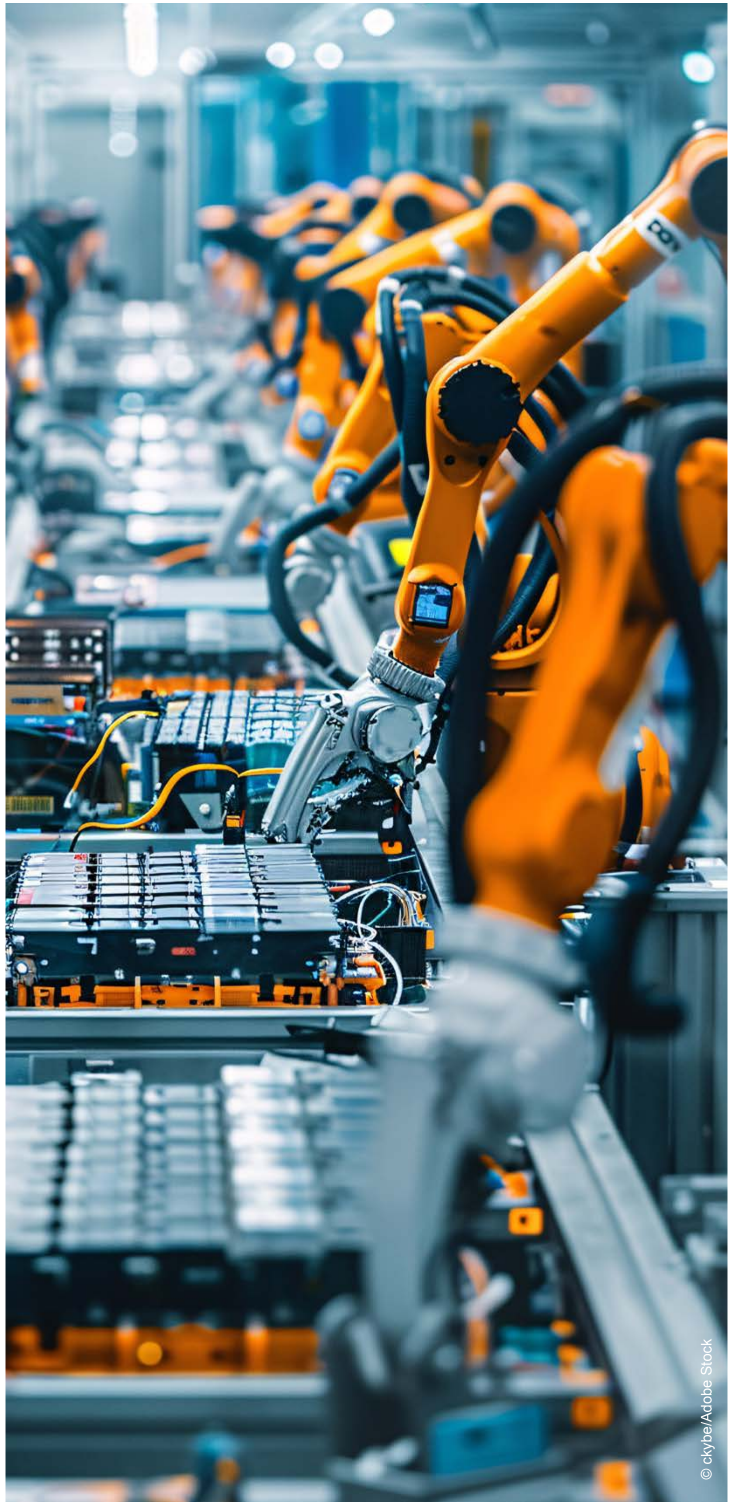
The realization of large-scale mining projects is a process that usually takes between 10 and 18 years (S&P Global 2025). A project is developed in stages. It starts with the exploration phase, followed by the environmental impact assessments, obtainment of SLO through engagement with local communities affected by the project, securing financing, and finally the obtainment of the legal operating license. Several factors may affect the process, such as reputational risks that may complicate the achievement of acceptance and support of a project by communities and/or stakeholders. As mining projects are capital intensive, this risk may deter investors from financing mining projects in the EU.

With increased demand for metals, high volatility for metal prices, and declining ore grades in primary deposits, recent years have seen a growing interest in evaluating whether legacy mine tailings could be re-mined for strategic materials. Valuable elements may still be present in the tailings due to limitations of the processing methods of that time, or because the minerals in question were not previously targeted. Re-mining of old tailings can, on the one hand, enable remediation of the sites and decrease long-term environmental and social impacts. On the other hand, re-processing is a costly operation that involves risks and may cause new impacts (UNEP 2024).

A joint study by Transport and Environment (T&E), Earthworks, and Earthjustice points towards the promising potential of remining transition materials. In Europe, remined cobalt could power more than 185,000 BEVs (T&E 2023). While ultimately, the potential of re-mining tailings to supplement virgin extraction is still unknown (Maest 2023), there was a clear recommendation to the EU to leverage the CRMA strategic projects to explore re-mining. The EU Commission selected one project in Czech Republic as a strategic project to re-mine manganese from tailings (European Commission 2025c, Euro Manganese 2025).

185,000

ELECTRIC VEHICLES COULD BE POWERED BY REMAINED COBALT IN EUROPE



3.0 LIB RECYCLING IN EUROPE

By recycling LIB, it is possible to recover battery metals and establish resilient circular supply chains, at the same time creating revenues, allowing battery manufacturers to protect themselves against volatile commodity prices, reducing geopolitical dependencies, and benefitting the environment through reduced need for primary raw materials.

The Battery Regulation sets minimum thresholds for recycled material content for batteries entering the EU market (see fig 5) and specifies recovery rates for certain metals (see fig 4). While End-of-Life (EoL) LIBs are currently not available in sufficient quantities to feed the growing demand for battery minerals, by the end of the decade, the availability of EoL LIBs is forecasted to grow significantly. This is reflected in a growing number of LIB pre-treatment and/or refinement sites (in general battery recycling plants) put into operation or planned in the recent past, as well as the forming of cooperations between recyclers and battery or car manufacturers for providing recycling feedstock[4]. The majority of recycling feedstock currently comes from cell manufacturing/production scrap or in the form of batteries that have not been used.

4) These cooperations include stages from collection and dismantling (spokes) to mechanical and chemical recovery (hubs).

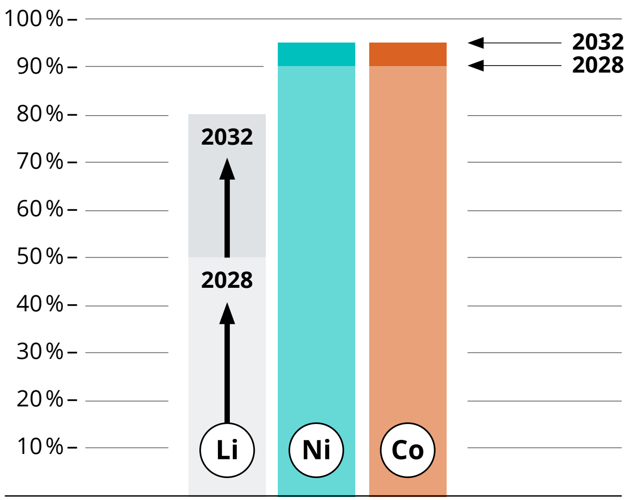


Figure 4: *CRM Recovery rates from EoL batteries in the EU specified by the new battery Regulation. Source: European Parliament 2023a.*

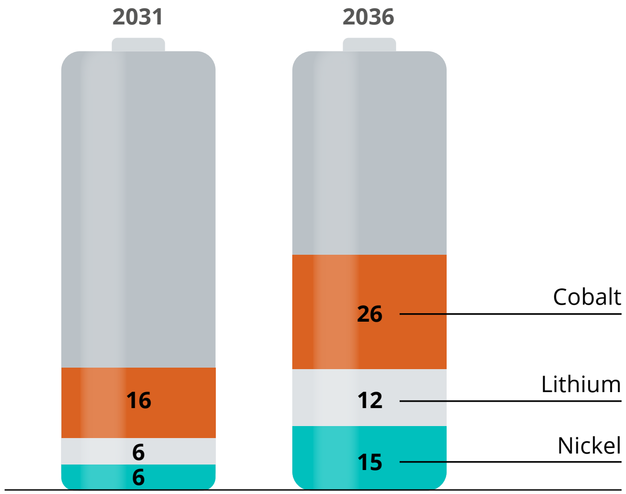


Figure 5: *Minimum recycled material content (in percent) for batteries entering the EU market specified by the new battery regulation Source: European Parliament 2023b.*

3.1 The Lithium-Ion Battery recycling process

There are a number of recycling technologies involving different pre-treatment and pyro- and/or hydrometallurgical processes. Which processes are applied depends on the battery chemistry and the ultimate goal of the recycling process (i.e., is the recovered material looped back into the battery production cycle, or does it go to other uses). Different processes can be combined in a number of variations (see fig 6). The following description is highly simplified and does not cover all available recycling schemes.

Most of the LIB recycling process schemes can be divided into two steps, which often take place at different locations called spokes and hubs. Some processes include a deactivation/discharge step beforehand:

Pre-treatment sites (spokes): Mechanical pre-treatment which consists of shredding or crushing the battery cells. The objective of this step is to separate "black mass" from the rest of the materials (iron, copper, and aluminium alloys, plastics, electronics, electrolytes, etc.). The main components of black mass are the anode and cathode materials, which contain graphite and compounds consisting of lithium, as well as, depending on the battery chemistry, cobalt, nickel, manganese, etc. These materials are then at least in part recovered in downstream metallurgical processes.

Refinement sites (hubs): The next recycling step serves to recover the metals of the black mass by pyrometallurgical and/ or hydrometallurgical processes to be used in new applications like batteries. In theory spokes should be situated to optimise collection logistics, whereas hubs for processing the black mass should be well connected in terms of infrastructure. This is partly because LIBs are classified as dangerous goods, and their transportation is costly, while the onward transportation of black mass to the hubs, while mostly classified as hazardous, is easier.

Pyrometallurgical processing with subsequent separation and hydrometallurgical refining steps is still one of the most common recycling routes. Pyrometallurgical methods mostly aim for the recovery of copper and a nickel-cobalt alloy. If lithium and aluminium are not separated in the pre-treatment of the battery cells or recovered from the black mass beforehand, they are usually not recovered at all.

Hydrometallurgical processes without a pyrometallurgical step require extensive pre-treatment to achieve similar recovery rates for nickel and cobalt but have the advantage of possibly also recovering other components of the battery cell, like graphite. Lithium can be recovered directly from the black mass, before further treatment occurs.

The diversity of battery recycling technologies and routes calls for sustainability considerations. There is no consensus on the 'best' technology or process due to variations in input materials, local conditions, market demand and prices for secondary materials. Furthermore, cathode chemistries are constantly evolving, and different recycling approaches are suited for different battery compositions and chemistries. Recycling technologies and routes vary considerably in terms of their environmental footprint and social, health, and safety risks (Systemiq 2025).

As discussed above, the main target materials of the recycling process in the EU are copper, nickel, and cobalt. Lithium recovery has so far been achieved in very few processes or is at the research and development (R&D) stage. However, from 2028 onwards, lithium recovery will be mandatory in the EU. There are also R&D and pilot testing activities for the recovery of graphite from LIBs.

With the growing market for LFP batteries, concerns about recovering battery materials from these chemistries are rising. The relatively lower value of the

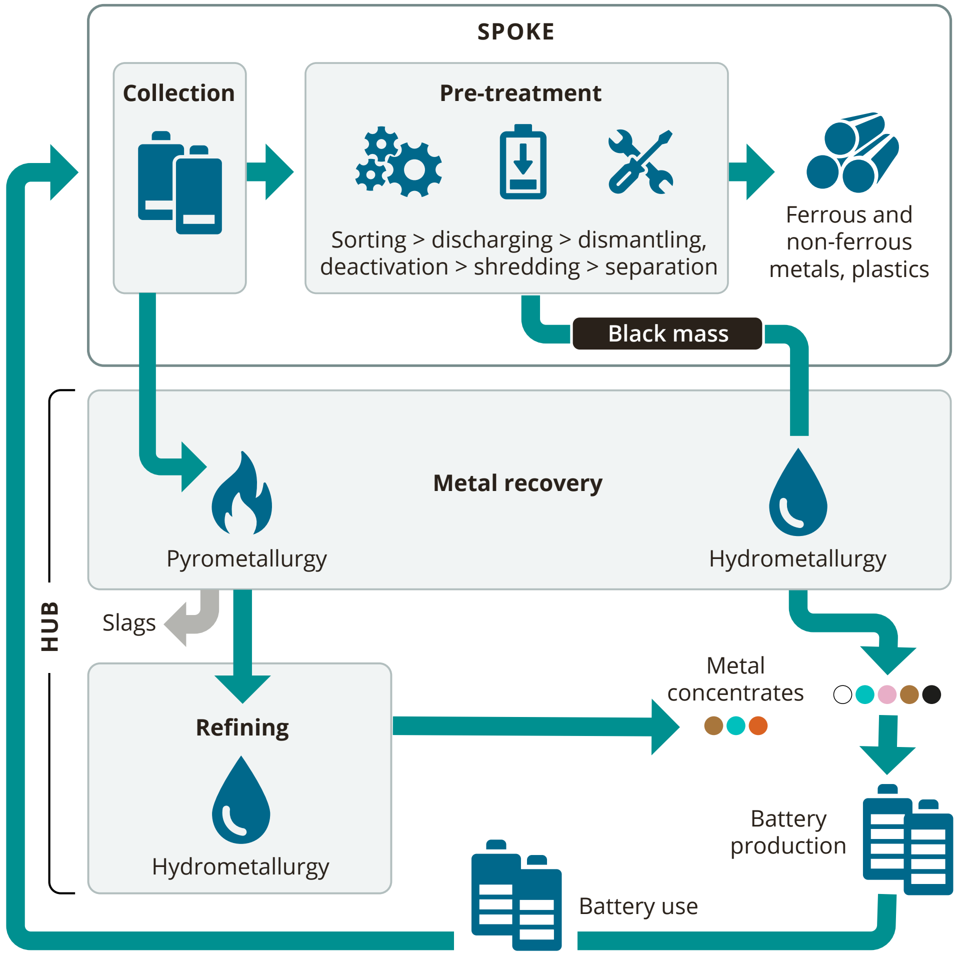


Figure 6: Overview of LIB battery recycling processes. Source: own design.

battery materials, coupled with the high energy intensity of the recycling process, currently pose economic barriers to exploring LFP battery recycling at large scale, increasing the risk of their irresponsible disposal (Fastmarkets 2024).

3.2 The EU's LIB current and future recycling capacities

Due to their historic use in steel and aluminium production, uncomplicated procedures and relatively simple equipment requirements, pyrometallurgy-based processes are still common for battery recycling at large scales (Ma et al. 2025). However, material selectivity of pyrometallurgical processes is relatively low, and fulfilling the minimum thresholds for battery material recycling laid down in the new 2023 Battery Regulation is not possible with these technologies alone. At the same time, pyrometallurgical processes are not economically viable for LFP batteries (Ma et al. 2025).

This highlights the need for advancing hydrometallurgical recycling technologies and for advancing the operationalization of new hydrometallurgy-based recycling facilities across the EU.

The 7 recycling projects selected as strategic under the CRMA reflect this reality, aiming at improving the recovery of battery-grade cathode materials, and some even for the recovery of graphite, promoting cutting-edge technologies and innovative approaches (European Commission 2025b).

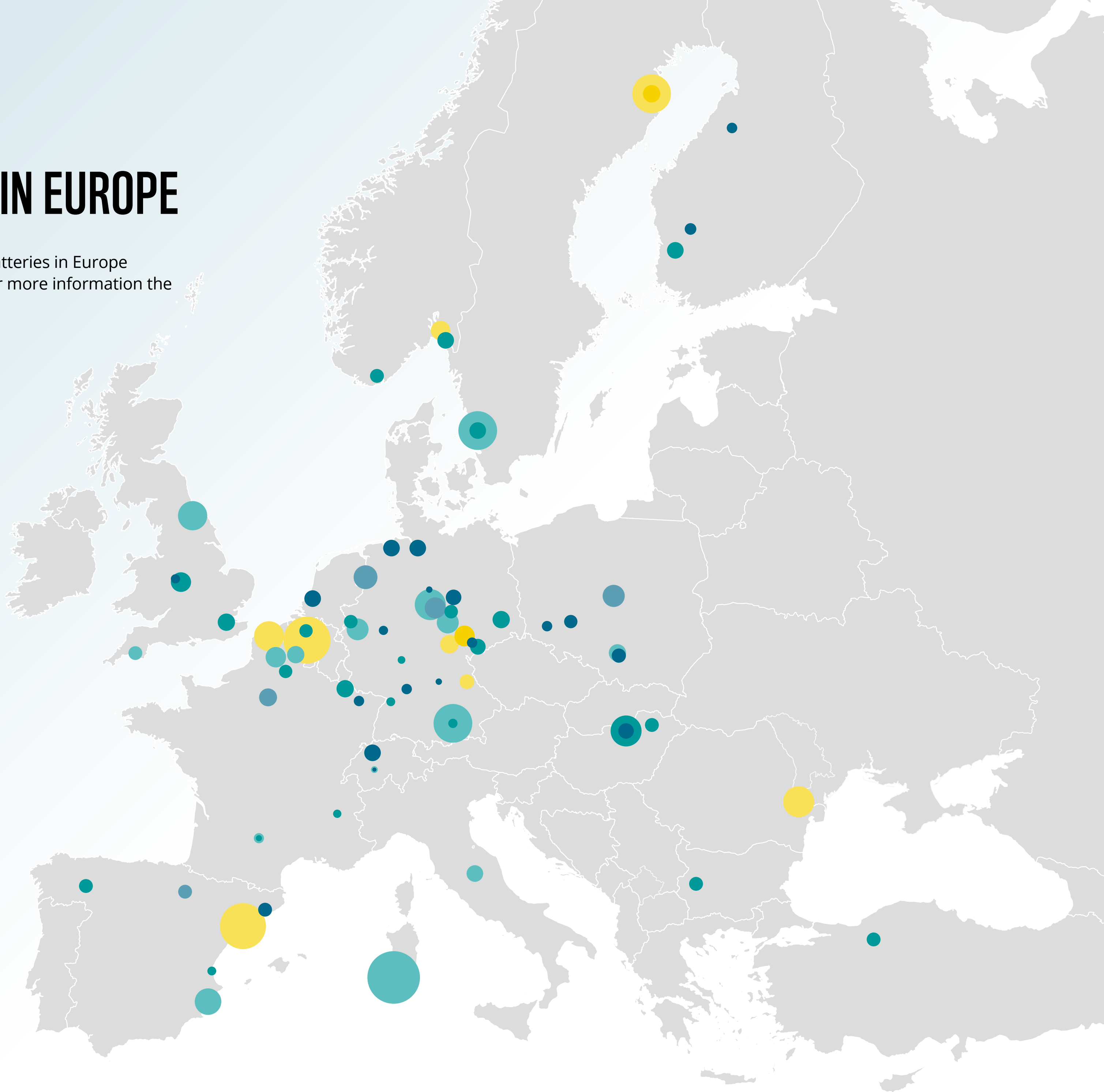
Additionally, to the CRMA strategic projects, a large number of battery recycling spokes and hubs are planned across the EU. The exact number of recycling plants to be built in the next years is difficult to estimate, as permitting processes can be lengthy and depend on the support of local communities (see chapter 5). Many projects are in pilot stages without certainty of their scalability. Furthermore, some of the announced battery recycling projects were cancelled in the years 2024 and 2025 due to the slowdown of battery production in Europe.

In Europe, according to a study by the Fraunhofer Institute with data from Q2 2025, the cumulative capacities of hubs will exceed the capacities of spokes in 2030 (Fraunhofer 2025). However, the definition and classification of several recycling facilities as a hub in this study are debatable. Furthermore, Europe still acts as a net exporter of black mass to Asia. Other studies conclude that there is and will be more pre-treatment than refinement in Europe (e.g. T&E 2024b). Map 2 shows current installed, planned/announced and cancelled recycling sites in Europe.

MAP 2

RECYCLING SITES FOR LITHIUM-ION BATTERIES IN EUROPE

Existing and announced recycling sites for lithium-ion batteries in Europe (as of July 2025). Source: Fraunhofer 2025. Please see for more information the *map on the Fraunhofer website »*



400,000 t

RECYCLING CAPACITIES PER YEAR BY 2026 FOR LITHIUM-ION BATTERIES IN EUROPE ARE TARGETED

3.3 Expected fulfilment of CRMA goals by recycling, per strategic material

With Europe ramping up its battery production while BESS and BEV batteries increasingly reach end-of-life, recycling feedstock availability is expected to experience exponential growth between 2030 and 2040. The recovered lithium, nickel, cobalt, and manganese is estimated to cover between 14% and 40% of the demand from BEV and BESS by 2030, rising to 24%–68% by 2040, depending on the specific metal (see fig 7 below).

The CRMA benchmark of recycling capacity to cover at least 25% of the EU's strategic raw materials consumption is expected to be met by 2030 only by cobalt, according to a T&E estimation. This is due to its high recyclability and increasing availability as cobalt-containing batteries are fed back into the loop, coupled with a decreasing market share of this metal as non-cobalt battery chemistries are increasingly favoured. All other metals are predicted to fall short of the benchmark values by 2030 (T&E 2024a).

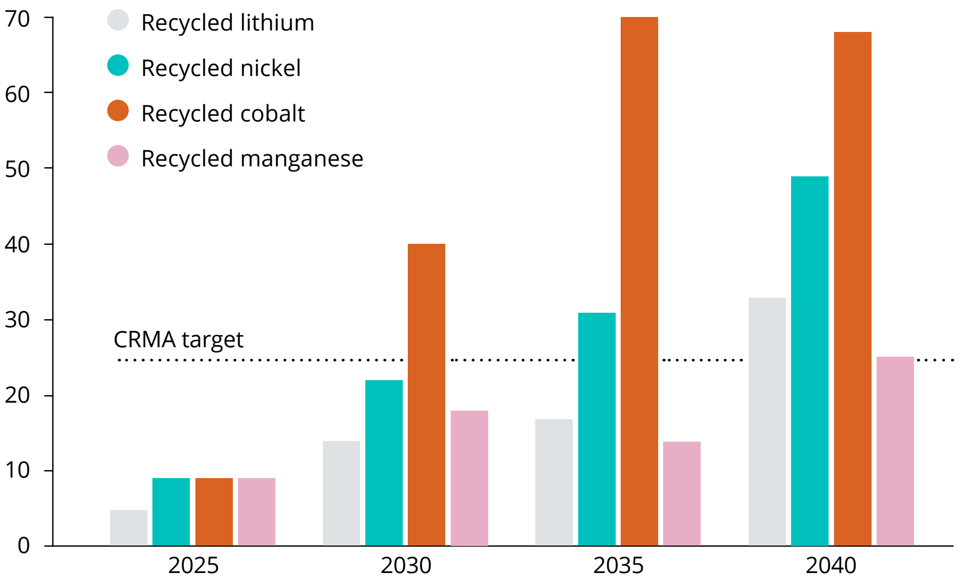


Figure 7: Raw material recycled content compared to raw material demand from BEV & BESS. Source: T&E 2024a.

The European Commission is much more optimistic in this respect: it predicts that the CRMA benchmark for recycled content will be met by the selected strategic projects alone by 2030 for lithium, manganese, and cobalt (see factsheets at European Commission 2025b)[5]. Compared to other forecasts, the European Commission calculates lower future demand for these raw materials, leading to a different outlook[6].

However, as a growing number of batteries reach end-of-life and are fed back into the recycling loop, along with technology improvements and increasing metal recovery rates, the CRMA benchmarks are likely to be met for all metals by 2040 (T&E 2024a).

There is significant potential for satisfying demand for battery raw materials from secondary sources in the future (see e.g. Urban Mining platform of the Horizon Project FutuRaM 2025). However, this is strongly dependent upon industrial and political support to implement the planned recycling capacities in the EU.

5) As mentioned for the CRMA strategic projects of mining raw materials in the EU, it is also uncertain if every strategic recycling project will be implemented.

6) It should be noted that there is no agreement on this among experts, as some scenarios predict a shortfall for all raw materials including cobalt in 2030 (e.g., Benchmark Source 2024).

4.0 NEGATIVE ENVIRONMENTAL AND SOCIAL IMPACTS OF MINING AND RECYCLING AND RELEVANT EU LEGISLATION

The extent of negative or positive impacts of mining of strategic materials and battery recycling on the environment and local communities depends very much on the specific location characteristics of the environment, size of the mine, mined ores, recycling technology and applicable laws regarding permits and environmental protection in the regions and countries.

A study on environmental and social impacts of mining in the EU, commissioned by the European Parliament in 2022, identified a "clear lack of EU-wide assessments of mining conflicts and (...) no systematic analysis at the EU-level of the environmental and social impacts" (Mononen et al. 2022, p. 9). The impacts of mining and battery recycling on the environment and human health are therefore outlined here in a highly generalised manner. These impacts are not limited to mining and battery recycling in Europe but apply to mining and recycling activities worldwide. If European data/examples of environmental and social impacts were available, they were used for this section.

It becomes evident that negative effects are predominantly listed in the environmental sector, as mining is mainly associated with negative aspects regarding the environment. The practical implementation and use of renewable energies, for example, varies depending on the type of mining. While this publication focuses on the negative effects, there can be positive impacts as well, such as benefits on the economic development of a region and the local population (OECD 2025).

While the environmental and social impacts of mining have been studied and documented extensively over the whole world, the impacts of recycling are less well documented.

4.1 Environmental and social impacts of transition raw materials mining

The environmental impacts of transition raw materials mining for batteries depend on a number of factors, from the chemistry of the battery itself to the source of raw materials in its production. Impacts of a mine vary depending on the stage of the main activity (exploration, construction, production and closure) and strongly depend on the locality, local environment, social or legal conditions, and on the method of extraction (Mononen et al. 2022, OECD 2025a). Most impacts arise from the mid-phase activities of the mine, construction and production. The impacts in fig 8 on the next page thus focus on these (own design based on Mononen et al. 2022). Open-pit mining generally has a much larger and more visible environmental footprint than underground mining, since it significantly alters the topography and destroys vast areas of vegetation at the surface level (Mononen et. al. 2022).

The impacts of a mine extend far beyond its direct vicinity. Mining related terrestrial infrastructure like roads or railway lines fragment wildlife habitats and dissect ecological corridors (Simkins et al. 2023). Infrastructure (including dams and power lines) built in previously pristine landscapes facilitate access and human migration to former wilderness areas (WWF 2023). Indirect impacts include the migration of mine workers to areas with newly opened mines, which brings about additional land-use changes due to logging, pasture use, agricultural development and water abstraction (Maus 2022). The negative social and environmental impacts of mining can be severe and outlast the activity itself by hundreds or even thousands of years.

IMPACTS OF A MINE VARY DEPENDING ON THE STAGE OF THE MAIN ACTIVITY AND STRONGLY DEPEND ON THE LOCALITY, LOCAL ENVIRONMENT, SOCIAL OR LEGAL CONDITIONS, AND ON THE METHOD OF EXTRACTION.

Figure 8:

POTENTIAL ENVIRONMENTAL IMPACTS OF MINING

LAND

- Changes to land, topography and landscape
- Erosion
- Waste rock and tailings
- Alteration of soil profiles and risks of contamination
- Habitat changes, fragmentation and loss
- Loss of vegetation and deforestation

WATER

- Changes in hydrology
- Ground and surface water impacts
- Changes in water quality (e.g.clouding)
- Controlled wastewater discharges and their cumulative impacts
- Increasing water scarcity in arid areas
- Risks of contamination, acid mine drainage, dam accidents, dewatering

OTHER

- Light pollution
- Air quality, dust and smell
- Noise pollution
- Vibration
- Climate impacts
- Radiation

Impacts on landscapes and biodiversity

The construction of a mine changes the landscape and the topography as habitats are destroyed or fragmented to gain access to a deposit. This can directly contribute to biodiversity loss and ecosystem degradation through deforestation and land conversion. The direct impacts of mining activities indirectly cause local changes in land-use patterns, which in turn have further environmental, economic, and social implications.

Recent research revealed that 85 % of Europe's strategic raw material occurrences are located beneath environmentally protected areas, or within a 5 km radius of them. This represents a substantial governance challenge regarding the implementation of the CRMA's ambitious goals, particularly in light of the Nature Restoration Law's requirement to restore at least 20 % of EU land and sea areas by 2030 (Falck & Correia 2023).

Impacts on air and climate

Mining causes direct emissions during all stages of the mine cycle, comprising both greenhouse gases (GHG) and particulate matter. Deforestation and land conversion additionally impact the climate by increasing greenhouse gas emissions and disrupting natural carbon sequestration processes.

While the mining sector is globally responsible for 4–7 % of annual GHG emissions (McKinsey 2020), in the EU, the mining and quarrying sector was responsible for only around 1–2 % of total annual GHG emissions between 2008 and 2022. Furthermore, GHG emissions from the sector have been experiencing a downward trend (OECD 2025a). CO_2 emissions are mostly caused by heavy machinery, such as hauling trucks or excavators, and the energy demand for mining extraction and processing. Transportation and shipping of mineral ores from mining to processing and manufacturing sites and onward to national and global hubs additionally generates large quantities of GHG emissions.

Fugitive emissions of dust and fine particles can also cause environmental pollution and negative health impacts and can contain silica dust which can lead to lung damage and respiratory diseases (Saka et al. 2025).

Mining waste

In countries with a strong mining sector, such as Finland and Sweden, mining waste can make up 80 % or more of the share of total domestically generated waste per year. While over 95 % of mining waste generated in the EU is non-hazardous, the share of hazardous mining waste to total hazardous waste has been increasing. In some countries, such as Finland, almost all hazardous waste comes from the mining sector (OECD 2025a).

Poor management of such waste can result in heavy metal contamination of soils and water (also downstream). Major sources of toxic pollution from mining are red mud from aluminium production, contributing to increased natural radioactivity, and acid mine drainage (the leaching of acidic water from metal mines) from sulphide mines (de Haes & Lucas, 2024).

Impacts on Water

The mining sector is at the forefront of the water challenge. It is highly dependent on the availability of large quantities of water, while also having serious impacts on water availability and quality.

The World Resources Institute found that at least 16 % of the world's land-based critical mineral mines, deposits and districts are located in areas already facing high or extremely high levels of water stress. This includes sites in countries like Spain and Portugal (Lakshman 2024). In a study of a sample of 33 of mining-related petitions to the European Parliament, 11 mentioned impacts on freshwater availability and quality (Mononen et al. 2022).

Water demand for mining operations can impact communities in the vicinity of mine sites, as well as downstream of rivers. Disruption of water courses and water contamination can cause significant environmental changes and affect water availability for cooking and irrigation. Conflicts between communities and mining operators arise in many places (Schoderer & Ott 2022).

Acid mine drainage, leaks from tailings, waste rock dumps, or direct disposal of tailings into waterways may contaminate surface and groundwater bodies. Emissions of nitrogen can cause eutrophication and releases of heavy metals, which are of a more toxic nature, often difficult to abate by wastewater treatment infrastructure (Meißner 2021, WWF 2020).

Social impacts of mining

In Europe, environmental and social impacts of mining are closely intertwined. Negative social impacts and associated negative public perceptions often relate to negative environmental legacies of mining operations in the past in the EU (Falck & Correia 2023, Mononen et al. 2022). Many communities around old mine sites in the EU still suffer the consequences of acid mine drainage, landscape alteration or biodiversity loss (OECD 2025a).

Lacking or inadequate engagement with affected communities and rightsholders in the initial phases of a mining project are another salient concern of local communities. This can occur especially if the related EIA and/or SIA was done or perceived to have been implemented in an incomplete way (Mononen et al. 2022). Minerals and mining projects are often geographically concentrated in rural and remote regions, home to a relatively high proportion of Indigenous peoples (OECD 2025a). Indigenous peoples are among the groups most affected by mining activities. By altering landscapes, mining can lead to the loss of land and water that holds cultural heritage and spiritual significance – once a place of cultural value is lost, it is difficult to compensate for it (NRDC 2022). These lands and freshwater resources are also a livelihood, an economic resource, and intrinsic to the identity and way of life for Indigenous peoples. For example, mining has impacted Sámi land and reindeer populations in Sweden having environmental, social, and economic repercussions (Larsen et al. 2022). However, negative social impacts can also result from poor working conditions in the mine and related activities.

Mining offers many potential benefits in terms of employment, wealth creation, state revenues, and infrastructure investment (OECD 2025a). Yet, disputes can easily arise regarding land rights and resource access, distribution of wealth and benefits, as well as entry, construction, and exit issues. Social and environmental impacts all have the potential to increase local vulnerability and contribute to conflicts (Marin & Palazzo 2025).

INDIGENOUS PEOPLE
ARE AMONG THE GROUPS MOST AFFECTED BY MINING ACTIVITIES

4.2 Environmental and social impacts of battery recycling activities in Europe

The negative impacts of mining on the environment and local populations described in the previous sections, and the dependency of the EU on other countries on primary raw materials, make a case for increasingly replacing primary raw materials with recycled raw materials.

Recycling and reusing strategic battery materials can help conserve natural resources and reduce the environmental impact associated with the extraction and processing of primary materials. A recent T&E report finds that EU and UK-recycled battery materials can reduce the need for primary ores, avoiding the need to build 12 new mines globally by 2040 (4 lithium, 3 nickel, 4 cobalt, and 1 manganese mine of average size) (T&E 2024b).

However, depending on the process and the energy mix used for it, battery recycling still causes environmental impacts, mainly on local levels.

The biggest environmental culprit regarding recycling processes are CO_2 emissions. Electricity consumption is the main cause of all the environmental impacts of LIB recycling according to life cycle assessments. The choice of electricity sources can quintuple greenhouse gas emissions (Machala et al. 2025). Due to the high energy input needed for pyrometallurgical processes, these are very emissions intensive. Nevertheless, a recent study found that an innovative pyrometallurgy battery recycling process resulted in 58 % to 81 % less greenhouse gas emissions, used 72 % to 88 % less water and 77 % to 89 % less energy than mining and processing new chemicals (Stanford 2025).

Another challenge is the toxicological risks associated with the treatment of batteries. Toxic chemicals can be released, particularly in the event of incidents such as fires. Hydrometallurgical processes leach the targeted minerals from black mass or other intermediates and thus generate high volumes of wastewater, if the water is not reused. Some of the processes also use hazardous chemicals (Zanoletti et al. 2024).

As the components of an LIB are in part toxic, high occupational safety provisions are necessary. Factory workers may come in direct physical contact with these chemicals during the manual sorting process of portable batteries or when the cells are opened, posing a health hazard. However, the primary concern with regard to safety pertains to the inherent risks associated with the LIBs themselves, given the potential hazards of fire and explosion. Necessary safety precautions have to be taken to mitigate these risks and create a safe working environment.

CO_2 EMISSIONS
ARE THE BIGGEST ENVIRONMENTAL CULPRIT REGARDING RECYCLING PROCESSES.

4.2 EU legislative framework regarding mining and battery recycling projects

Globally, the European Union maintains one of the strongest and most extensive environmental legislative frameworks. While there is no comprehensive EU-wide law governing environmental issues related to mining, these are regulated by various EU laws and regulations. EU Directives are applicable to all member States and set a harmonized set of standards but can differ in their implementation at national level. However, laws relating to mining can be contradictory between different government levels (OECD 2025a). Table 2 gives a brief overview of some of the most relevant EU legislation that contains environmental and social protection provisions related to the mining and battery recycling industries, besides the CRMA and battery Regulation.

Environmental permitting is a key area where EU legislation shapes mining practices. Directives such as the Industrial Emissions Directive (IED 2.0), the Extractive Waste Directive, the Water Framework Directive (WFD) and the Nature Directives (Habitats Directive and Birds Directive) set conditions and processes for permitting. Mining projects typically require an EIA to evaluate potential impacts before approval. The EIA, which includes public participation, is considered the most influential factor in permitting decisions by the industry (Mononen et al. 2023, OECD 2025a).

While the EU environmental legislation is applicable in all EU member states, the actual regulation of the mining sector regarding licensing, royalties and operational conditions is managed by national mining laws in each member state. This makes it difficult to oversee the legal conditions for establishing new mining projects in each country.

There has been no meaningful analysis of clashes between the CRMA and relevant European environmental legislation such as the Birds and Habitats, Water Framework, or the Biodiversity Strategy (Ehrmann & Vesa 2025). On the contrary, the strategic projects may be able to override EU environmental legislation due to their “public interest” status.

With the CRMA and the Omnibus process for the “simplification” of corporate sustainability responsibility in full force, the EU is continuing down the slippery slope of weakening its environmental standards. The WFD is the next victim of the imperative to “secure access to critical raw materials in the EU”. The revision of the WFD, on the agenda for 2026, is seen as a clear concession to the mining and extractives industry (EEB 2025a, EEB & WWF 2025).

At the same time of weakening environmental EU standards some of the EU regulations are not up-to-date. The Extractive Waste Directive (European Parliament 2006), the only piece of explicit EU mining legislation, is 20 years out of date, giving rise to concerns over the security of tailing dams or the legitimacy of what companies claim to be “best practices” (Marin & Ritchey 2025, T&E 2024c).

Legislation	Purpose	Implications for mining and recycling industry
Environmental Impact Assessment (EIA) Directive (2011/92/EU, amended by 2014/52/EU)	• Requires mining and major industrial projects to undergo an environmental impact assessment before approval.	• Directly influences permitting decisions and mining operations • Recycling facilities must report on resource use, waste, and worker health. • Increased risk mitigation • Public consultation has increased transparency. • Projects may face delays.

Strategic Environmental Assessment (SEA) Directive (2001/42/EC)	• Requires that environmental considerations be integrated into public plans and programmes at an early, strategic stage – before individual projects are approved
	• Ensures a high level of environmental protection
	• Complements the EIA Directive, which applies to specific projects
		• Requires assessment of the environmental impacts of public plans and programs, including:
		  • Regional or national minerals development plans, mining waste management strategies, or land-use frameworks triggering new mining permits
		  • Some plans for industrial zoning or energy and materials infrastructure that underpin mineral processing
		  • National or municipal waste and recycling plans – including e-waste or critical raw materials recovery initiatives

Nature Directives: Habitats Directive (92/43/EEC) Birds Directive (2009/147/EC) and Natura 2000 network	• Established the Natura 2000 network of protected areas • Meant to protect 1000+ wild species and 200+ habitats.	• Limits mining and processing activities in protected areas and bird habitats, requiring environmental impact assessments and potential mitigation or exclusion zones.
Water Framework Directive (2000/60/EC)	• Aims to protect and improve water quality and manage water resources sustainably. • Strict standards to reduce pollutants that can contaminate water bodies. • Reduce the mixing of industrial wastewater into groundwater.	• Mining operations must draft water management protocols and ensure responsible water use. • Battery recycling plants need to control wastewater discharges and install a closed-loop water system • Relevant for recycling facilities using hydrometallurgy. • Impacts permits and operational costs for water treatment and monitoring
Extractive Waste Directive (2006/21/EC)	• The only EU law applicable specifically to mining • Regulates management of waste from extractive industries to prevent environmental and health risks, including hazardous mining waste.	• Imposes strict waste management and facility standards, influ-encing mine tailings disposal and remediation costs • encourages best available techniques to minimize environmental impact of mining waste • Increased financial cost for implementation.
Mineral Extractive Industries Health and Safety Directive (92/104/EC)	• Provides minimum requirements for worker safety and health in mineral extraction activities.	• Requires compliance with health and safety standards in mining operations, impacting operational procedures and worker training • Underpins responsible sourcing and ethical supply chains.

***Table 2:** Overview most relevant EU legislation related to the mining and battery industries.*

Continued on next page (25)

Legislation	Purpose	Implications for mining and recycling industry
Environmental Liability Directive (Directive 2004/35/EC)	• Ensures that operators responsible for environmental harm bear the costs of prevention and remediation under the polluter-pays principle. • Enforces environmental accountability across industries.	• Falling under Annex III activities, mining and mineral processing operators are automatically responsible for damage without needing proof of fault. • Increased permitting rigour, strengthened site closure and rehabilitation obligations. • Mandatory financial provisioning for environmental risk • Increased operator awareness and prevention • higher compliance costs and stricter due diligence requirements
Industrial Emissions Directive (2010/75/EU)	• To prevent and reduce pollution and emissions from industrial activities using Best Available Techniques (BAT). • Focuses on emissions that impact air, water, and soil • Encourages cleaner technology.	• Includes metal extraction activities since 2024 • Processing plants and recycling facilities must meet strict emission limits, • Battery recycling facilities must limit the use of hazardous chemicals and energy. • Limits recycling plants' methods to minimize emissions. • Influence on technology choices
REACH Regulation (EC 1907/2006)	• Ensures safe use of chemicals by requiring registration, evaluation, authorization, and restriction of substances.	• Promotes safe handling of chemicals that are used in mining operations. • Battery recyclers must avoid specific hazardous chemicals in recycling methods. • Recyclers may need to register recovered materials and demonstrate safe use of reagents
Seveso III Directive (2012/18/EU)	• Prevents major accidents involving dangerous chemicals and limits the impacts on human and environmental health.	• Companies must develop safety protocols. • Transparency to the public regarding hazardous chemicals. • Ensures battery storage or recycling plants are handling recycled materials properly. • Requires safety reports and emergency protocols.
Mercury Regulation (EU 2017/852)	• Reduce and restrict mercury use in industrial activities, including waste and emissions.	• Mining operations cannot use mercury for ASGM. • Mercury is seen as hazardous waste and must follow waste protocols.
Transfrontier Shipment of Waste Regulation (EC 1013/2006)	• Ensures safe and responsible export of waste across borders. • Prevents illegal waste-shipping to countries with lower environmental standards.	• Battery recyclers must comply with the requirements to export battery waste legally. • Encourages intra-EU battery waste recycling.
Waste Framework Directive (2008/98/EC)	• Ensures waste management across the EU with a focus on circularity. • Establishes waste management hierarchy focused on prevention, reuse, recycling, and recovery.	• Sets framework for waste handling of batteries, encouraging circular economy through recycling targets, Extended Producer Responsibility (EPR), and minimizing landfill.

5.0 SOCIAL LICENSE TO OPERATE

5.1 Social License to Operate and why it is important

In addition to their positive effects on the economy, high-impact industries like mining or recycling create negative environmental and social externalities that affect communities living in the vicinity, or even society at a larger scale.

Failure to address issues that matter to local communities can lead to protests. These can have a wide range of impacts, including higher costs for delayed projects, cancellation of projects or reputational damage for the company. Local communities even have the power to entirely halt operations, ultimately hampering the objectives of the CRMA. Impacts on one company may also spill over to other players in the industry, for example when they result in the imposition of more stringent regulations. This reality underpins the necessity that strategic projects should pay particular attention of the acceptance of large operations by affected communities, conceptualised as “Social License to Operate” (SLO) (Stuart et al. 2023).

The term originates from the mining sector to highlight the need for the industry to go beyond regulatory requirements to maintain good relationships with affected communities and other local stakeholders such as civil society organisations, local authorities or educational institutions.

Although there is no globally accepted definition of SLO, it broadly represents the ongoing acceptance, approval, and support of a project from communities (Stuart et al. 2023). While coming from the mining sector, the concept of SLO can be transferred to other high-impact industries like recycling.

SLO links companies to communities and societies by building and nourishing long-term relationships, aiming to achieve beneficial outcomes. These include continuously improving mitigation of environmental and social impacts. Since it is a dynamic and continuous process based on individuals’ perceptions which can change over time, the local community, and society more broadly, can grant but also revoke a particular SLO at any time (Tost et al. 2021).

In Europe, historically there is a strong trust in governance bodies and government to act in the best interest of its citizens, and in adhering to all relevant regulations in the licensing processes. Here, SLO encompasses different scales (from local to global) and touches different policy and societal levels (mining, environment, land use, circular economy, etc). Hence, SLO on the community level is complemented by a societal level SLO. Trust in government to regulate the industry is the common ground between the two. To give an example: a project might achieve SLO because a community perceives its environmental impact on a river to be acceptable (community level) or because its con-

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tribution to climate change mitigation is accepted by an NGOs (societal level) (Lesser et al. 2021). While the CRMA does not stipulate public stakeholder consultations during the selection process of the strategic projects, it clearly requires that strategic projects must present "a plan containing measures to facilitate public acceptance including, where appropriate, measures to facilitate the meaningful involvement and active participation of affected communities" from the start and during the entire lifespan of the project. For projects with the potential to impact Indigenous peoples, measures dedicated to a meaningful consultation and engagement of the affected Indigenous peoples are required (European Parliament 2024).

The involvement of the public and especially Indigenous peoples in the development of such projects of "public interest" is paramount. Europe is a continent marked by high population density and few remaining natural habitats. Undertakings that jeopardise the integrity of Europe's remaining natural spaces may be met with scepticism from the public.

5.2 How companies achieve SLO

The guidelines of the SLO model developed as part of the EU-funded MIREU (Mining and Metallurgy Regions of EU) project identify six drivers of trust and acceptance for community level and societal SLO in Europe (Lesser et al. 2021, Tost et al. 2021).

Good governance and political trust play a central role in SLO. Within the societal and political context, the company itself needs to build long-term positive engagement with local stakeholders. As a first step, it is key to identify the local stakeholders. Subsequently, transparent and active communication and an ongoing participatory approach from the very beginning build and underpin trust with the local community.

At the same time, permitting and regulatory authorities must reliably fulfil their obligations in their permitting and licensing roles, and actively participate in

COMMUNITY SLO	SOCIETAL SLO
Contact Quality Most important determinant of community SLO. Relationship primarily between company and community, with government facilitation if necessary.	**Legal & Procedural Fairness** Government and regulatory frameworks have legitimacy, and industry adheres to laws and behaves respectfully.
Perceived Procedural Fairness Community believes the company follows laws and is willing to go beyond them to ensure respectful treatment.	**Confidence in Government** Society trusts that the entire governmental system (including judiciary) protects their interests and holds industry accountable.
Social Benefit Beyond jobs and municipal revenue, social benefits occur when a community believes the company respects its values and supports its future vision.	**Distributional Fairness** Mining revenues are distributed equitably with affected communities and used for the common societal good.

Table 3: *Drivers of trust and acceptance from community level and societal SLO in Europe.*

the relationship building process. This includes relationships and partnerships with communities, civil society, companies and other governmental authorities at the local, regional, national and EU levels. Authorities can also assume the role of impartial mediators in case of disputes between communities and companies (Tost et al. 2021).

Besides good governance and trust building, SLO also depends on external factors that may be difficult to influence. Causes of opposition to specific mining projects may be rooted in resource nationalism, where there is opposition against foreign companies, or negative past experiences with similar mines (Lesser 2021). With regards to establishing new recycling plants, public opposition may be lower in locations within established industry parks and in regions that are historically more industrialised.

The following success factors were identified for engaging with communities in a transparent and trustful way to achieve SLO:

- Continuous active stakeholder involvement from the earliest stages of the process, e.g. by public stakeholder meetings with the openness to feedback (listening, giving feedback) and adjustments (changing designs).
- Presenting and explaining plans/receiving feedback/having discussions about problems.
- Changes or adjustments to plans based on feedback and suggestions from local stakeholders (e.g., favouring underground over open-pit mining in Natura 2000 areas, even when this is linked to higher costs).
- Involvement of Indigenous Peoples in land use and rehabilitation planning.
- Cooperation with independent agencies to facilitate participatory planning processes.
- Multi-method participation approaches to engage with as many stakeholders as possible.
- Involvement of impartial third parties, e.g. universities or independent agencies for civil society engagement process facilitation or for data collection and monitoring.
- Good relationship with the municipality, provincial and regional government, administrations, and institutions.
- Involvement of media to ensure transparent communication.
- Direct engagement of the company with the municipality: Agreement of support of socio-economic development and integration into everyday municipal life.

(Lesser at al. 2021, Tost et al. 2021 & interviews)

5.3 SLO on the ground: challenges with mining and recycling projects in Europe

In the recent past, there have been examples of mining companies struggling with approval to extend their operations or open new projects, and of recycling projects meeting resistance from local civil society groups, delaying and stopping licensing and construction procedures.

In Portugal and Serbia, mining companies have been found to engage in questionable practices to achieve SLO, ranging from “social engineering”[7] to outright intimidation of opponents (UDCB et al. 2024). Licensing processes have been in-transparent in European mining projects (e.g. in Spain and Portugal), with mining companies systematically denying stakeholders the right to access project documentation (UDCB et al. 2024, EU Raw Materials Coalition 2025, EU Raw Materials Coalition 2025a).

Jadar Project in Serbia

A current example that illustrates how not securing SLO at the community and the society level can lead to freezing an entire project is Rio Tinto’s Jadar project in Serbia.

The Jadar deposit near Loznica in western Serbia contains an estimated 135 million tonnes of ore and is one of the largest undeveloped lithium resources in Europe. In 2025, the mine was selected as a strategic project under the CRMA, with experts estimating that it could supply up to 90% of the EU’s lithium demand once in operation (Deconinck 2025, Reuters 2025). Rio Tinto has been studying the Jadar deposit since 2001; however, in November 2025, after years of local opposition eventually growing into nation-wide protests supported by

7) Social engineering refers to efforts in influencing particular attitudes and social behaviours on a large scale. In the context of mining the term refers to unethical methods to gain social acceptability, such as manipulating public opinion by spreading misleading information.

civil society organisations, media and members of the scientific community, the project was frozen and placed on indefinite "care and maintenance" status (Vivoda & Loginova 2025, Rio Tinto 2026).

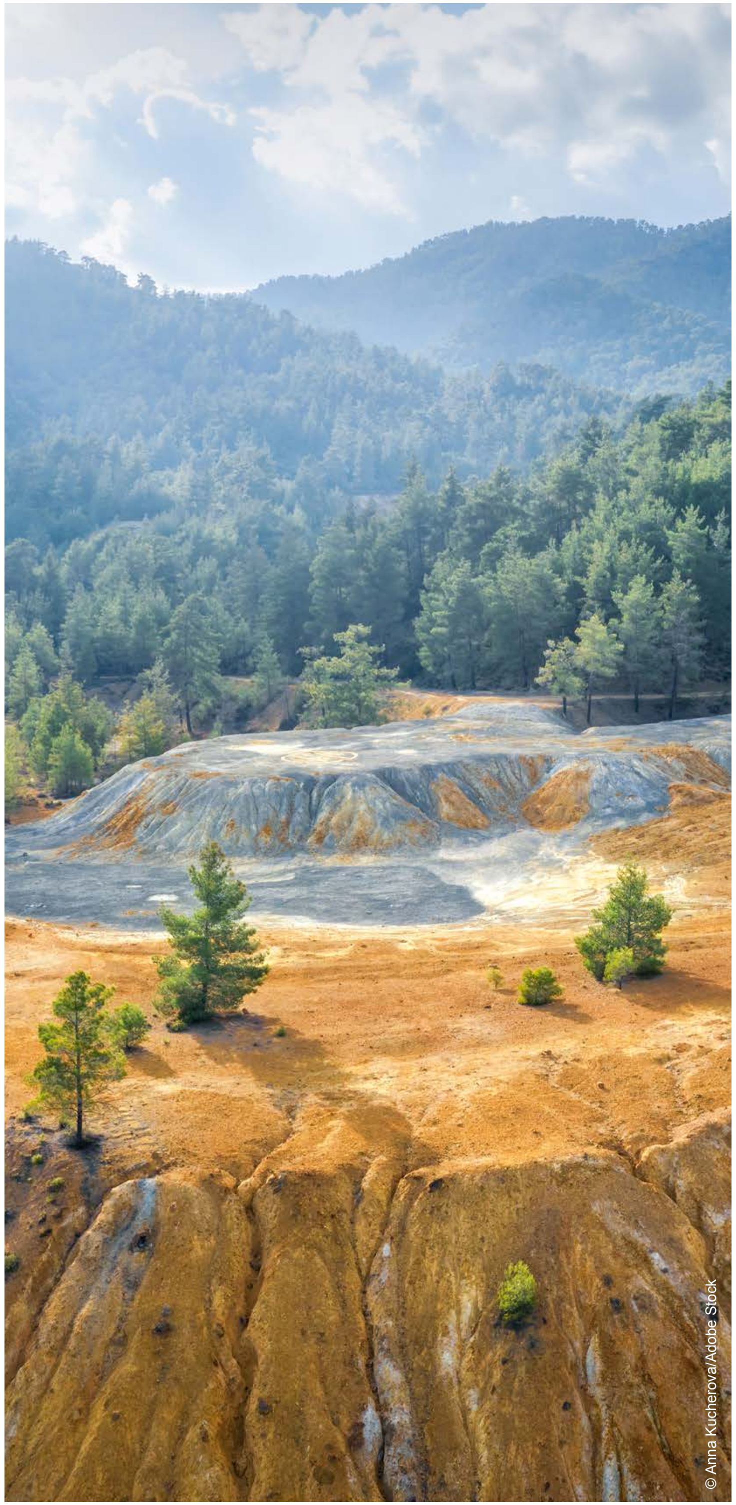
How did it come to this deadlock? Government and corporate stakeholders (the EU, the Serbian government and Rio Tinto) failed to engage with local communities in a meaningful way at an early stage, taking their concerns seriously. Instead, engagement was widely perceived as top-down, late, and procedural, rather than participatory. Communities felt excluded from decision-making, environmental risks – especially to water, soil, and agriculture – were inadequately addressed, and technical information was not shared in a transparent or accessible way. Government alignment with the investor further eroded trust, reinforcing perceptions that national and EU strategic interests outweighed local welfare. Heavy-handed responses to protests deepened polarization (Friends of the Earth Europe 2025, Perišić 2025,). As of early 2026, althought the project has not been cancelled, it was de-prioritized by the company, making its outcome uncertain (electrive 2025).

Talvivaara mine in Finland

Another example is the Talvivaara mine in Finland, where polymetallic ores were mined. The mine enjoyed general local and national support for many years. But the public opinion shifted after it became known that the company intended to mine for uranium in 2010. Growing negativity, also involving a pond leak in 2012, resulted in nationwide protests, which impacted the entire Finnish mining industry. In response, the government launched its plan for sustainable mining, and the Finnish Independence Fund (Sitra) created the Finnish Network for Sustainable Mining, a collaborative forum between mining companies and stakeholders including NGOs. The incident also sparked far-reaching reforms in mine management, improving transparency, communication, safety, and environmental measures (Lesser et al. 2021a).

SungEel Recycling facility in Germany

In the recycling sector, the case of SungEel Recycling in Gera-Cretzschwith in Germany, is an example of an ongoing struggle for SLO. Permission for the construction of a battery recycling facility (spoke) by Korean investor SungEel in Gera, Germany, is pending after vehement opposition from a local citizens' initiative. The company had announced its plans in 2023, and by February 2025, the debate was still ongoing. Citizens had raised a number of concerns, including worries over missing environmental impact assessments, lack of transparency of pollution metrics in the submitted documents, concerns over species protection, and unsuitability of the proposed site to handle the associated heavy traffic. The citizens' concerns were also motivated by the company's tainted reputation after a fire incident at a plant in Hungary in July 2022. In 2023, SungEel and Samsung had already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been forced to withdraw its application for the construction of a battery recycling plant in Rudolstadt, in the same federal state, due to public opposition (EUWID 2024a, EUWID 2024b). Local civil society is also hindering the permitting process for a factory by Finnish battery recycling group Fortum, citing environmental, health, and safety concerns (EUWID 2024c).

5.4 SLO on the ground: Success stories of mining and recycling projects in Europe

The following cases demonstrate positive outcomes for society and companies if SLO is granted due to meaningful engagement with stakeholders. There are no long-term SLO experiences from recycling facilities, but the given examples (interviews conducted with the companies) demonstrate how recycling companies gained trusts and may achieve longer-term SLO by transparent communication and community engagement.

Sakatti mine in Finland

The Sakatti mine in northern Finland, run by Anglo-American, produces nickel and copper and was established in 2011. Before its opening, there was some opposition to the mine from the local community, from reindeer herders who feared that mining activities would interfere with their herding, and most of all, from the Finnish Association for Nature Conservation (FANC) who continues to oppose the mine, as the targeted ore deposits are partly located in a Natura 2000 area.

The company has a track record of engaging with stakeholders, resulting in diminishing opposition from the local community since the opening of the mine. Among other things, the company has also refrained from open-pit access to ores in the protected areas in question and has opted for underground mining in the Natura 2000 area. The sustainable mining plan, developed in 2022 with the local community, is based on continuous stakeholder partnership and engagement. Regular public stakeholder meetings are held, which give the local community and authorities the opportunity for feedback. Adjustments to the company's activities, such as the operation of snow cannons or defining the location of new discharge pipes, are made based on community feedback (SUMEX2022).

Barruecopardo mine in Spain

In the second example, Tungsten was mined in Barruecopardo in Spain since 1902 until the 1980s but was then revived in 2019 by the company Saloro. This company focused on creating good relationships with all stakeholders contributing to high levels of support from the community. SLO-related activities of Saloro include ensuring high transparency about its operations, including disclosing any information requested by authorities, the media, or the community.

Concrete actions of Saloro involve signing an agreement with the municipality to support socio-economic development, including a preference for residents to work in the mine. The company is also integrated into municipal life by participation in local festivals and inviting neighbours to their annual mining event. The company maintains continuous relationships with local educational institutions, including involvement in local schools and collaboration agreements with the University of Salamanca for internships (Lesser et al. 2021a).

Li-Cycle's recycling facility in Germany

Li-Cycle's establishment in Magdeburg (acquired by Glencore after Li-Cycles bankruptcy) exemplifies a successful SLO strategy, which has been reflected in consistent positive coverage by the regional press. The company seeks to achieve SLO by serving as a reliable and trustworthy partner. Li-Cycle engages meaningfully with local stakeholders and demonstrates accountability in both community relations and environmental performance. Its decision to repurpose existing industrial facilities to initiate its operations, thereby minimizing environmental impact and optimizing resource efficiency, reinforces its image as an environmentally conscious and economically considerate enterprise.

Li-Cycle's stakeholder engagement in Magdeburg was characterized by concrete and continuous community outreach: approximately one year prior to the commencement of operations, the company hosted a community barbecue, extending personal invitations. This early outreach facilitated open dialogue and helped establish mutual trust well before production activities began. Subsequent events, including the official inauguration of the recycling facility, have further strengthened transparency and public goodwill. Moreover, Li-Cycle contributed to the community through support for local emergency services, education, and safety programs, as well as participation in the Industrial Park's Open House. These initiatives collectively embodied the company's long-term commitment to partnership and shared growth.

cylib recycling facility in Germany

Following the successful operation of its pilot plant in Aachen, cylib is now establishing an industrial-scale production facility within the existing CHEMPARK Dormagen. This strategic decision leverages the infrastructure and expertise of a well-established chemical park, ensuring efficient integration and operational readiness. The CHEMPARK provides extensive facilitation for overarching activities, including compliance with site-level safety and environmental standards, and management of essential utilities such as water supply and wastewater disposal. This approach minimizes environmental impact and benefits from a stakeholder environment accustomed to chemical production activities. CHEMPARK maintains a holistic view of site operations and coordinates actions that foster acceptance among stakeholders. This centralized approach facilitates transparency and trust-building. Beside the use of the existing infrastructure and trust-building through engagement with local stakeholders cylib is further reinforcing trust through adherence to recognized standards like DIN EN ISO 14001:2015 (Environmental Management), ISO 50001:2018 (Energy Management), and ISO 9001:2015 (Quality Management). These certifications demonstrate commitment to sustainability, energy efficiency, and quality assurance.

While the CHEMPARK assumes responsibility for overarching SLO measures, cylib itself has not yet implemented a dedicated SLO strategy at the company level. This reliance on the park's established framework ensures compliance but presents an opportunity for cylib to develop its own proactive approach in the future.

6.0 CONCLUSIONS AND RECOMMENDATIONS

To achieve the CRMA benchmarks for domestic raw material supply to support more resilient supply chains of critical and strategic raw materials for the energy transition, and to reduce over-reliance on third countries, the EU's raw material supply capacities must be dramatically expanded.

According to a recent report by the European Court of Auditors, the EU's efforts to secure critical raw materials are falling dangerously short. Attempts to diversify import sources have yielded little tangible progress – while the EU has signed 14 strategic raw material partnerships over the past five years, seven of those partners are considered unreliable, and imports from partner countries actually declined for roughly half of the materials examined. Recycling targets are also far from being met, with recycling rates for seven out of 26 transition raw materials standing at just one to five percent, and ten others – including lithium and gallium – not being recycled at all. On the domestic side, mining expansion is slow due to low exploration activity and long lead times, while processing capacity is actually shrinking as facilities are shut down, partly due to high energy costs. The auditors warn that transparency is lacking throughout, targets are too vaguely defined, and it remains uncertain whether lost capacities can be restored (ECA 2026).

6.1 Conclusion

Securing transition raw material supply

The number of strategic projects selected under the CRMA for each activity – extraction, processing, recycling and substitution - shows a clear political preference for pushing the extraction of primary raw materials. While 15 projects will receive support for extraction activities, only 7 have been selected for recycling projects, and only one of the selected projects will deal with material substitution.

WWF promotes a preference of recycling over primary extraction. Recycling has clear environmental benefits over mining, including lower greenhouse gas emissions as well as lower rates of land use, and soil and water pollution. Furthermore, recycling has the potential to meet a high share of the resource demand in the EU even in the near future. By 2040, EU and UK-recycled battery materials could reduce the need for primary ores, so far as to avoid the need to build 12 new mines globally (T&E 2024b).

BY 2040,
EU AND UK-RECYCLED BATTERY MATERIALS COULD REDUCE THE NEED FOR PRIMARY ORES, SO FAR AS TO AVOID THE NEED TO BUILD 12 NEW MINES GLOBALLY.

On a large scale, recycling can thus also underpin long-term supply security – physically and geopolitically – of strategic battery minerals. The net environmental benefits of recycling LIBs also far outweigh their negative impacts, with regard to waste treatment and resource efficiency, while reducing the risk of toxic chemicals polluting water and soil. The efforts for recovering the resources are worthwhile. This is especially true compared to the environmental and social impacts of mining.

Collection networks will be key in achieving the goals, as an increasing amount of EoL BEV batteries will become available over the next years. This will be facilitated by extended producer responsibility (EPR) stipulated in the Battery Regulation, which mandates that the original equipment manufacturer is responsible for the collection of automotive EoL LIBs for recycling[8].

There is significant potential for satisfying demand for battery raw materials from secondary sources in the future. However, this is strongly dependent upon industrial and political support to implement the planned recycling capacities in the EU.

True circularity goes beyond recycling

As an advocate of a new paradigm built around a circular economy, WWF promotes decision-making on all levels along a mitigation hierarchy: avoid, repurpose, reuse, recycle. The EU's policies regarding battery minerals in the light of a circular economy, such as the Battery Regulation, place a strong focus on recycling.

While WWF supports the preference of secondary raw materials to primary extraction in line with the mitigation hierarchy, we encourage the EU to address systemic issues such as overconsumption and advocate waste minimisation by promoting material sufficiency, efficiency or replacement approaches and technologies, impact reduction, or reuse approaches. Examples include mandatory product lifetime extension for original component and original equipment manufacturers or promoting second-life uses for batteries in stationary energy storage. Extended producer responsibility can contribute to reducing overall resource use, when producers need to take responsibility for EoL waste management.

Sufficiency approaches include encouraging citizens to question the need for ever-larger cars and batteries, and promoting a "small is beautiful" mindset, or encouraging the use of public transport. Lastly, the responsibility cannot be placed in the hands of the industry and politicians alone – citizens need to take action themselves, change their habits, and demand change from their leaders to support public transport by allocating budget or expanding infrastructure.

8) They can however transfer this responsibility to producer responsibility organisations (PROs).

Due Diligence and Social License to Operate

WWF supports a green and just transition away from the fossil fuel-based economy. While recognizing the necessity and urgency to secure raw material supply for battery production in the EU, WWF also points to potential detrimental environmental impacts of mining and recycling projects and the necessity to secure SLO.

The establishment of new mines and recycling facilities in Europe is met with strong scepticism from the European population, especially in regions with no previous mining history or no established chemical industry. Mining has historically been linked to negative environmental impacts and human rights violations. It is therefore crucial for mining companies wishing to engage in extraction activities in the EU to assure they fulfil their due diligence and supply chain transparency obligations under the EU Corporate Sustainability Due Diligence Directive (CSDDD) (European Commission 2024b) and the new 2023 Battery Regulation, among others.

WE ENCOURAGE THE EU TO ADDRESS SYSTEMIC ISSUES SUCH AS OVERCONSUMPTION AND ADVOCATE WASTE MINIMISATION BY PROMOTING MATERIAL SUFFICIENCY, EFFICIENCY OR REPLACEMENT APPROACHES AND TECHNOLOGIES, IMPACT REDUCTION, OR REUSE APPROACHES.

The CSDDD is currently being revised under the Omnibus process. WWF does not agree with the dilution of the EU's corporate environmental and social responsibility frameworks under this "simplification" process and encourages companies to go beyond compliance by adhering to frameworks such as OECD Due Diligence Guidance for responsible Business Conduct or OECD Handbook on Environmental Due Diligence in Mineral Supply Chains (OECD 2025, OECD 2023), regardless of the outcome of the Omnibus process. The OECD Handbook addresses environmental risks in the upstream segment (extraction to transformation) and provides resources for both upstream and downstream actors. The handbook also promotes circular economy principles and emphasizes managing environmental risks linked to primary and secondary material supplies.

From environmental and social perspectives, the CRMA has been criticized for taking an overly economic point of view benefiting mostly corporate interests, potentially sacrificing environmental and social safeguards. The selection process of the strategic projects has been opaque and was largely conducted without public participation. This is particularly problematic as the strategic projects are considered matters of "public interest" and as such may be able to override existing environmental legislation or frameworks. WWF is also concerned about the shortened permitting timelines for strategic projects, which could lead to incomplete EIA and SIA and thus to negative environmental and social impacts for the local communities surrounding mining sites.

Given Europe's high population density, coupled with a strong civil society and media landscape, it is crucial to apprehend the environmental impacts of new projects and secure the support of external stakeholders. Environmental impacts from mines that affect local communities, or even anticipated negative impacts of planned mines, can lead to strong public opposition if not communicated transparently, participatively and in a timely manner.

Amid such concerns, selected strategic projects should pay particular attention to attaining SLO at the highest level and proactively engage in communication with the stakeholders. The EU should make sure that the citizens' trust in their governments to represent them, their interests, and their well-being is not jeopardised by ambiguous legislation or lack of public participation. This should include the conclusion of a social impact assessment (SIA) to provide relevant information on how the envisaged action will change the life of residents, communities and regions. An SIA includes the process of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change process invoked by those interventions (definition by International Association for Impact Assessment) (Sairinen 2022).

Local populations and affected parties must be meaningfully engaged and Indigenous peoples and other rights holders must be granted their right to Free and Prior Informed Consent (FPIC). Effective grievance mechanisms must be in place to prevent social engineering and other unethical methods to gain acceptability.

SELECTED STRATEGIC PROJECTS SHOULD PAY PARTICULAR ATTENTION TO ATTAINING SLO AT THE HIGHEST LEVEL AND PROACTIVELY ENGAGE IN COMMUNICATION WITH THE STAKEHOLDERS.

6.2 Policy and industry recommendations

Policy recommendations

1. Prioritize circular economy and recycling over extraction

- Increase financial and regulatory support for battery recycling projects to match or exceed those for mining projects.
- Support innovative recycling and R&D projects to be able to meet the recycled content targets set by the Battery Regulation, especially for lithium.
- Increase financial and regulatory support for the re-use, re-pair and re-manufacturing of batteries for a second life application/use.

2. Reform and strengthen EU legislation

- Conduct a legal compatibility assessment between CRMA "strategic project" status and existing EU environmental directives (Birds and Habitat Directives, Water Framework Directive) and ensure strategic projects cannot override environmental protection.
- Do not use the CRMA and the "security & simplification" narrative to dilute EU environmental legislation pillars.
- Update the Mining Waste Directive to mandate Best Available Techniques (BAT) such as filtered tailings, clarify liability, and strengthen environmental safeguards.

3. Support local acceptance through transparent governance

- Make civil society consultation mandatory in strategic project selection and environmental permitting processes.
- Make SIAs a legal requirement for any strategic project of "public interest".
- Develop EU-level SLO Guidelines based on the MIREU model, promoting procedural fairness, transparency, and benefit-sharing.
- Establish an EU SLO Monitoring Body to track project-community relations and compliance with stakeholder engagement.
- Ensure mining companies fulfil their due diligence and supply chain transparency obligations under OECD guidelines, the EU Corporate Sustainability Due Diligence Directive (CSDDD), and the new Battery Regulation.

Industry recommendations

1. Integrate SLO strategies from day one

- Start community engagement during the earliest project stages, using open forums and third-party facilitators.
- Build trust with consistent, transparent communication and integrate community feedback into project design.

2. Focus on building long-term positive relationships with local communities and governments, ensuring procedural fairness and providing social benefits beyond economic gains

- Collaborate with local schools and universities to build the future workforce.
- Create community benefits programs, including local hiring commitments, shared infrastructure, or revenue-sharing agreements.

3. Follow international frameworks (OECD Due Diligence, EU CSDDD, Battery Regulation), commit to third-party audits of social and environmental performance (e.g. IRMA), and publicly disclose supply chain due diligence.

4. Prioritize recycling innovation

- Invest in hydrometallurgical recycling technologies to meet EU recovery rate mandates and reduce local environmental impacts.
- Develop recycling technologies that can process LFP chemistries economically and sustainably.

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ANNEX 1: *Complete list of Strategic projects under the CRMA, as of January 2026 (European Commission 2025c)*

Name	Type	Promoter	Country	Strategic raw material	confirmed
Aguablanca Project	Extraction	RIO NARCEA RECURSOS S.A.	Spain	Cobalt, Platinum Group Metals, Nickel (battery grade), Copper	***Project factsheet***
Rovina	Extraction	Euro Sun Mining Inc.	Romania	Copper	***Project factsheet***
SALROM Baia de Fier	Extraction	Societatea Națională a Sării S.A.	Romania	Graphite (battery grade)	***Project factsheet***
Talga Natural Graphite ONE	Extraction	Talga AB	Sweden	Graphite (battery grade)	***Project factsheet***
Zero Carbon Lithium	Extraction	Vulcan Energie Ressourcen GmbH	Germany	Lithium (battery grade)	***Project factsheet***
Romano Mine	Extraction	Lusorecursos Portugal Lithium S.A.Lithium (battery grade)	Portugal	Lithium (battery grade)	***Project factsheet***
Barroso Lithium Project	Extraction	Savannah Lithium Unipessoal, Lda	Portugal	Lithium (battery grade)	***Project factsheet***
MINA DOADE PROJECT	Extraction	RECURSOS MINERALES DE GALICIA, S.A.	Spain	Lithium (battery grade)	***Project factsheet***
LAS NAVAS	Extraction	LITHIUM IBERIA, S.L.	Spain	Lithium (battery grade)	***Project factsheet***
Verde Magnesium	Extraction	Verde Magnesium SRL.	Romania	Magnesium Metal	***Project factsheet***
Kolmisoppi	Extraction	Terrafame Ltd	Finland	Nickel (battery grade), Cobalt	***Project factsheet***
Mining project EL MOTO	Extraction	ABENÓJAR TUNGSTEN S.L.	Spain	Tungsten	***Project factsheet***
Metlen BAUX-EU, GALLANT, LEADER	Integrated: Extraction and processing	Metlen Energy and Metals and European Bauxites	Greece	Bauxite/alumina/aluminium, Gallium	***Project factsheet***
Sakatti Project	Integrated: Extraction and processing	Anglo American Services (UK) Ltd.	Finland	Cobalt, Platinum Group Metals, Copper, Nickel (battery grade)	***Project factsheet***
Neves Corvo - 3RD SILO, LOMBADOR, Semblana	Integrated: Extraction and processing	SOMINCOR	Portugal	Copper	***Project factsheet***
Polymetallic primary sulphite project PMR project	Integrated: Extraction and processing	Cobre las Cruces S.A.U.	Spain	Copper	***Project factsheet***

Name	Type	Promoter	Country	Strategic raw material	confirmed
Cínovec lithium project	Integrated: Extraction and processing	Geomet s.r.o.	Czechia	Lithium (battery grade)	*Project factsheet*
KELIBER LITHIUM PROJECT	Integrated: Extraction and processing	KELIBER TECHNOLOGY OY	Finland	Lithium (battery grade)	*Project factsheet*
Emili	Integrated: Extraction and processing	IMERYS Ceramics France	France	Lithium (battery grade)	*Project factsheet*
Ageli	Integrated: Extraction and processing	Eramet	France	Lithium (battery grade)	*Project factsheet*
Chvaletice Manganese Project	Integrated: Extraction and processing	Euro Manganese Inc	Czechia	Manganese (battery grade)	*Project factsheet*
ReeMAP Project: Malmberget, Lulea Industrial Park, Per Geijer	Integrated: Extraction and processing	LKAB (Luossavaara-Kirunavaara AB)	Sweden	Rare Earth Elements for Magnets	*Project factsheet*
La Parrilla Mine (P6 Metals)	Integrated: Extraction and processing	Iberian Resources Spain	Spain	Tungsten	*Project factsheet*
RECOVER-IT	Recycling	Circular Materials s.r.l.	Italy	Copper, Nickel (battery grade), Platinum Group Metals	*Project factsheet*
CirCular	Recycling	Atlantic Copper SLU	Spain	Copper, Platinum Group Metals, Nickel	*Project factsheet*
Hydrometallurgy	Recycling	ORANO Batteries	France	Lithium (battery grade), Cobalt, Nickel (battery grade), Manganese, Graphite (battery grade)	*Project factsheet*
Project Fortum Hydromet	Recycling	Fortum Battery Recycling Oy	Finland	Lithium (battery grade), Copper, Nickel (battery grade), Cobalt	*Project factsheet*
Portovesme CRM Hub	Recycling	Portovesme srl	Italy	Lithium (battery grade), Nickel, Cobalt, Copper	*Project factsheet*
NorthCYCLE	Recycling	Northvolt Revolt AB	Sweden	Manganese (battery grade), Lithium (battery grade), Graphite (battery grade), Nickel (battery grade), Cobalt	No factsheet available
POLVOLT	Recycling	Elemental Battery Metals Sp. z o.o.	Poland	Nickel (battery grade), Copper, Cobalt, Lithium (battery grade), Platinum Group Metals, Manganese (battery grade)	*Project factsheet*

Name	Type	Promoter	Country	Strategic raw material	confirmed
Alpha Project	Recycling	Solvay Chimica Italia Spa	Italy	Platinum Group Metals	*Project factsheet*
MagFactory	Recycling	MagREEsource	France	Rare Earth Elements for Magnets	*Project factsheet*
LIFE-22-ENV- IT- INSPIREE	Recycling	Itelyum Regeneration SpA	Italy	Rare Earth Elements for Magnets	*Project factsheet*
GePETO	Processing	Umicore	Belgium	Germanium	*Project factsheet*
CO_2 Graphite	Processing	UP Catalyst	Estonia	Graphite (battery grade)	*Project factsheet*
Hycamite TCD Technologies Ltd	Processing	Hycamite TCD Technologies Ltd.	Finland	Graphite (battery grade)	*Project factsheet*
Jervois Finland Cobalt Refinery Expansion Project	Processing	Jervois Finland Oy	Finland	Cobalt	*Project factsheet*
BAM4EVER (Phase I&II)	Processing	Tokai COBEX savoie	France	Graphite (battery grade)	*Project factsheet*
European Initiative for Strategic and Sustaina-ble Graphite Production	Processing	NGC Battery Materials GmbH	France (main location), Namibia, Germany	Graphite (battery grade)	*Project factsheet*
Viridian Lithium	Processing	Viridian Lithium	France	Lithium (battery grade)	*Project factsheet*
Lithium Hydroxide Converter Guben	Processing	Rock Tech Guben GmbH	Germany	Lithium (battery grade)	*Project factsheet*
Lift One	Processing	Lifthium energy, S.A.	Portugal	Lithium (battery grade)	*Project factsheet*
GALLICAM	Processing	SIBANYE-STILLWATER SANDOUVILLE REFINERY	France	Nickel (battery grade), Cobalt (battery grade), Lithium (battery grade), Graphite (battery grade), Manganese (battery grade), Copper	*Project factsheet*
Pulawy Rare Earths Separation Plant	Processing	Mkango Resources Ltd.	Poland	Rare Earth Elements for Magnets	*Project factsheet*
CAREMAG	Processing	CAREMAG SAS	France	Rare Earth Elements for Magnets, Boron (metallurgy grade)	*Project factsheet*
ReGAIN	Substitution	Umicore	Belgium	Germanium	*Project factsheet*
ProHiPerSi	Substitution	PCC Thorion GmbH	Germany	Graphite (battery grade)	*Project factsheet*

ANNEX 2: *Current and planned mining projects in Europe*

Mineral	Country	Planned extraction capacity **active or confirmed projects** (kt/a)	Planned extraction capacity**unconfirmed projects** (kt/a)	Total number of potential mining projects		CRMA Strategic projects
				confirmed	**unconfirmed**	
Lithium	Austria	2.9	N/A	1	0	0
	Czech Republic	4.9	N/A	1	0	1
	Finland	4.3	N.I.	1	1	1
	France	11.8	N/A	2	0	2
	Germany	12.2	N/A	2	0	1
	Portugal	13.6	N/A	3	0	2
	Spain	127.8	N/A	3	0	2
	Sweden	N/A	N.I.	0	3	0
Nickel	Finland	41.3	1.47	2	2	2 (Ni & Co)
	Greece	N/A	20.0	0	1	0
	Italy	N/A	N.I.	0	1	0
	Spain	N.I.	N.I.	1	1	1 (Ni & Co)
	Sweden	N/A	N.I.	0	2	0
Cobalt	Finland	3.5	0.26	2	4	2 (Ni & Co)
	Italy	N/A	N.I.	0	1	0
	Spain	N.I.	N.I.	1	1	1 (Ni & Co)
	Czech Republic	N.I.	N/A	1	0	1
Magnese	Sweden	120	N/A	1	0	1
Graphite	Romania	N.I.	N/A.	1	0	1
	Austria	0.1	N/A	1	0	0
	Finland	N.A.	N.I.	0	1	0
	Germany	N. I.	N/A	1	0	0

OUR MISSION IS TO STOP DEGRADATION OF THE PLANET'S NATURAL ENVIRONMENT AND TO BUILD A FUTURE IN WHICH HUMANS LIVE IN HARMONY WITH NATURE.

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WWF International
Rue Mauverney 28
1196 Gland
Switzerland
wwf.panda.org