Management of GHG Emissions and Mine Waste within Critical Mineral Mine Operations in Indonesia

International Energy Agency

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Introduction

This report is the result of a cooperative initiative between the International Energy Agency (IEA) and Indonesia's Ministry of Energy and Mineral Resources (MEMR). The project was launched in early 2024 as part of the IEA's broader commitment to supporting sustainable and responsible critical mineral supply chains.[1]

This initiative stems from the increasing global focus on the environmental, social and governance (ESG) dimension associated with critical minerals production. Emerging regulatory frameworks in consumer countries, coupled with increasing market demand for sustainable and responsible supply chains, have created both challenges and opportunities for mineral-producing countries. Given Indonesia's strategic position as a major producer of critical minerals such as nickel and cobalt, the IEA and MEMR recognise the value of exploring pathways to strengthen ESG practices within the country's mining regime — particularly regarding greenhouse gas emissions and management of mine waste.

This analysis builds upon a comprehensive series of engagements, including an internal consultation held by the IEA with the MEMR and the Ministry of Environment, that support the IEA's preliminary legal and regulatory assessment. These consultations benefited significantly from insights shared by Indonesian government stakeholders, reinforcing the collaborative nature of this initiative and highlighting opportunities for aligning national frameworks with international best practices in critical mineral governance.

This initiative aims to identify and highlight existing good practices within Indonesia's mining regime while pinpointing opportunities where an increased focus on ESG practices can support further development of the critical minerals sector in Indonesia. The analysis presented herein identifies opportunities — which we frame as recommendations — that focus on potential pathways and options available to Indonesian policy makers. The findings are intended for internal use by MEMR and will serve as the foundation for future collaborative work to enhance Indonesia's ESG framework in the mining sector.

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Chapter 1. General Overview of Indonesia's Mining Regime

Mining Policy

Indonesia views minerals — including coal — as part of the national wealth. In accordance with the Indonesian Constitution, these resources are controlled by the State for the greatest prosperity of the people. This view is reflected in the laws governing mining activities and businesses, first enacted through Law Number 11 of 1967 concerning Basic Provisions on Mining ("Law 11/1967") and later replaced by Law Number 4 of 2009 concerning Mineral and Coal Mining ("Law 4/2009") and its amendments.

Law 11/1967 classified mineral resources into 3 classifications based on its value, but with the enactment of Law 4/2009, Indonesia rearranged the management of its mineral resources from the contract regime stipulated under Law 11/1967 into a licensing regime. Law 4/2009 categorises minerals and coal products into five (i.e. Radioactive Mineral; Metal Mineral such as nickel, copper, lithium, cobalt, and REE; Non-Metal Mineral such as graphite, rocks, including agate, andesite, and other rock non-metal mineral; and Coal), MEMR Decree Number 69.k/MB.01/MEM.B/2024 concerning Stipulation of Types of Commodities Classified in Strategic Mineral ("MEMR Decree 69/2024") further classified certain minerals which in their raw form have strategic value.[2]

MEMR Decree 69/2024 further provides that minerals which in their raw form have strategic value, as listed in its attachment, will be used as a reference in the stipulation of mineral products which need to undergo domestic value-add processing obligations as part of the Downstreaming Strategy. Regulations developed because of the Downstreaming Strategy include:

- Regulation on **Increasing Mineral Value Added Through Processing and Refining Activities**, which specifies requirements for in-country processing and refining in order to increase the value added to produced minerals;[3]

[2] Strategic value is based on whether such minerals constitute raw materials for strategic industries (e.g. electric vehicle industries, solar cell industries, and defence industries); the potential to control global markets through the domination of resources and/or reserves; large contribution to state revenue in the mineral mining sectors; and dominant contribution to the country's foreign exchange reserves.

[3] PerMen 25/2018 as amended by PerMen 50/2018

- Regulation on **Domestic Market Obligation**, which requires mining permit holders to fulfil domestic demand for mining products but does not specify a DMO level and instead enables MEMR to determine DMO requirements;[4]

- Regulation on **Restrictions on the Exports of Processed and Refined Minerals**, which sets out mechanisms to allow for the export of semi-processed products and some types of ores, including a requirement for MEMR export approval;[5]

- Regulation on **Divestment Procedures and Mechanism of Price Determination**, which details divestment procedures and requirements for foreign investors who hold shares in mining licences;[6] and

- Regulation on **Benchmark Pricing**, which creates an authorisation framework that enables MEMR to set mineral and coal benchmark prices, which are price floors for Government Royalty calculations.[7]

The enactment of Law 4/2009 has significantly changed the management of mineral resources in Indonesia, from the introduction of the licensing regime and classification of mineral products to the differentiation of licences required to operate mines during the exploration and extraction stages. Highlights of the changes between Law 11/1967 and Law 4/2009 can be found in the Annex.

Downstreaming Strategy

Mine operators are required to increase the value-add of mineral products domestically.[8] The increase in value-add of mineral products is measured by the extent to which raw minerals are processed and refined domestically into higher-value products like metals and alloys. It also considers how much of these processed minerals are used within Indonesia for manufacturing goods such as electronics and machinery. Additionally, the law evaluates the economic impact, including job creation and revenue generation, from these domestic processing activities. This obligation is part of Indonesia's 'Hilirisasi' or 'Downstreaming' Strategy, a policy popularised by former President Joko Widodo but initiated by his predecessor, President Susilo Bambang Yudhoyono, in the National Long-Term Development Plan 2005-2025. The main objective of this policy is to discourage the export of raw materials and encourage their local processing to

[4] PerMen 25/2018 as amended by PerMen 50/2018
[5] PerMen 25/2018 as amended by PerMen 50/2018
[6] PerMen 9/2017 as amended by PerMen 43/2018
[7] PerMen 7/2017 as amended by PerMen 44/2017 and Permen 19/2018
[8] Law 4/2009

stimulate resource-based industrialisation and is particularly focused on minerals with strategic value, such as nickel, cobalt, REE and copper.

Rights and Obligations of Mining Operators under Law 4/2009

Rights	Obligations
Utilise public infrastructure and facilities for mining needs	Apply proper mining techniques
Utilise public infrastructure and facilities for mining needs	Manage finances in accordance with the Indonesian accounting system
Entitled to the ownership of mineral products, including its derivatives, provided that the mandatory royalty payment has been paid	Increase the value-add of mineral product domestically
	Develop and empower the local community
	Comply with the environmental quality standard in accordance with the prevailing regulations on environmental protection and management

Source: IEA Analysis, Law No. 4/2009 on Mineral and Coal Mining.

Indonesia's Downstreaming Strategy has the potential to significantly boost the economy by attracting substantial foreign investment and fostering industrial growth. The policy has already led to a surge in the number of nickel smelters, from just two in 2016 to over 40 by 2024, with more under construction driven by foreign capital. This influx of investment has spurred economic growth in local districts with active nickel industrial parks. However, Indonesia can further leverage this strategy for broader economic benefits by meeting higher environmental, social and governance (ESG) standards that can attract investment from Western countries and ensure sustainable growth.

Mining Territory and Mining Licences

Law 4/2009 provides that anyone who wants to engage in the mining business must conduct its activities in accordance with: (a) the allocation of the mining territory; (b) the operational or mining licence issued by the Ministry of Energy and Mineral Resources ("MEMR"); and (c) the Business Licence issued by the central government through the Online Single Submission Risk-Based Approach ("OSS RBA").

Allocation of Mining Territory

Mining territory is classified based on its designation within the mineral resources management system. In general, mining operations by private actors are categorised under *Wilayah Usaha Pertambangan* or "WUP". Other mining territory classifications include those designated for community mining[9], state reserves[10], or conditional business mining operation within a state reserve[11].

To conduct mining operations in a mining territory, operators must obtain an allocation of the mining territory (either a *Wilayah Izin Usaha Pertambangan* or "WIUP" or *Wilayah Izin Usaha Pertambangan* Khusus or "WIUPK"). WIUP allocation can be obtained by private operators by applying to the ministry (for non-metal mineral mining) or through auction (for metal mineral and coal mining). The allocation for WIUPK is given on a priority basis for State or regional owned enterprises. In the event none of the prioritised enterprises is interested in taking the WIUPK allocation, private operators can be eligible to obtain the WIUPK allocation by auction.

Mining licences: Exploration and Production

The granting of a mining licence is divided into 2 stages: (a) the exploration stage, comprising general investigation, exploration, and feasibility studies, which requires an Exploration Licence; and (b) the operation production stage, which encompasses construction, mining, processing and refinery, enrichment or utilisation, transportation and sales of mining products, which requires an Operation and Production Licence.

Upon being granted an allocation, mining operators must apply for an Exploration Licence within 10 working days, which are valid for: 8 years (metal minerals), 7 years (coal and certain non-metal minerals), or 3 years (non-metal minerals and rock mining). After completing exploration activities, operators may apply for an Operation and Production Licence, which is valid for up to 20 years for metal minerals (extendable to 30 years with integrated smelter facilities), 20 years for coal (extendable to 30 years with refinery facilities), 20 years for certain non-metal minerals, 10 years for non-metal minerals, or 5 years for rock mining.

OSS RBA Business Licence

In order to conduct operations in Indonesia, business entities are required to obtain both a Business Licence as well as a Risk-Based Business Licence. The

[9] Wilayah Pertambangan Rakyat or "WPR"
[10] Wilayah Pencadangan Nasional or "WPN"
[11] Wilayah Usaha Pertambangan Khusus or "WUPK"

basic requirements for a Business Licence must be fulfilled before applying for a Risk-Based Business Licence. The basic requirements comprise of: (a) the conformity to spatial utilisation approval/location permit; (b) environmental approval; (c) building approval; and (d) building function worthiness certificate. This report covers only Environmental Approval.

Environmental approval for business licensing

Environmental approval is one of the basic business licensing requirements and needs to be obtained during the preparatory stages of a business. By definition, environmental approval refers to the approval given to the environmental document submitted by a business entity upon it passing a feasibility test and/or examination in accordance with quality standards set by the relevant authority.

Government Regulation Number 22 of 2021 on Implementation of Environmental Protection and Management ("GR 22/2021") requires each mining project to submit project-specific environmental documentation, which may take one of three forms and classified depending on the significance of the project's environmental impact.

Environmental approval for business licensing under GR 22/2021

Project-specific documentation	Environmental impact of a project
Environmental Impact Analysis (*Analisis Mengenai Dampak Lingkungan* or "AMDAL"	Significant environmental impact
Environmental Management Efforts and Environmental Monitoring Efforts (*Upaya Pengelolaan Lingkungan dan Upaya Pemantauan Lingkungan* or "UKL-UPL")	Moderate impact
Statement of Capability in Environmental Management and Monitoring *(Surat Pernyataan Kesanggupan Pengelolaan dan Pemantauan Lingkungan* or "SPPL")	Minimal environmental impact

Source: IEA Analysis, Government Regulation Number 22 of 2021 on Implementation of Environmental Protection and Management ("GR 22/2021").

Operational Licence

In addition to environmental approvals, mining companies must obtain operational licences under the Risk-Based Business Licensing system established by Law Number 11 of 2020 on Job Creation. This system classifies businesses into four risk categories: Low-Risk, Medium-Low Risk, Medium-High Risk and High-Risk. The mining of critical minerals and coal is classified as High-Risk Business,

requiring mining companies to obtain both a Business Identity Number (NIB) and an operational licence in the form of a mining licence issued by MEMR.

Environmental Management in Mining Operations

Mining licence holders are obligated to comply with environmental management laws operating under two parallel regulatory frameworks. The general environmental framework under Law 32/2009 applies to all business activities and requires environmental approval as described above. Additionally, Law 4/2009 mandates that mining activities comply with operational licences issued by MEMR, which provides the legal basis for MEMR's mining-specific environmental standards. The regulatory framework governing environmental management in the mining sector is fragmented across multiple sub-sectors at the ministerial level.

Environmental management for all business activities falls under Law 32/2009, which defines environmental protection and management as systematic and integrated efforts to preserve environmental functions whilst preventing pollution and damage. This encompasses planning, utilisation, control, preservation, supervision and law enforcement. This Environmental Approval obtained under this law serves as the foundation for Ministry of Environment supervision and monitoring of business activities, including mining operations.

For mineral mining, Law 4/2009's requirement for MEMR operational licences provides the legal authority for MEMR to establish sector-specific environmental standards through MEMR Regulation Number 26 of 2018 on Implementation of Good Mining Principles ("MEMR Reg 26/2018") and its implementing decree, MEMR Decree Number 1827 K/30/MEM/2018 on Guidelines for Implementation of Good Mining Governance ("MEMR Decree 1827"). These regulations, which operate as conditions of the mining licence rather than separate approvals, provide detailed standards for good mining governance, including environmental management. Under MEMR Reg 26/2018, both MEMR and regional governments are authorised to supervise and monitor good mining practices implementation, including environmental aspects, primarily through evaluation of periodic and incident-based mining operation reports submitted by licence holders.

During the IEA’s internal consultation with MEMR and the Ministry of Environment on 16 April 2025 (“Internal Consultation”), officials clarified that each ministry exercises distinct supervisory authority over environmental management in mining operations at the working level. The Ministry of Environment, as the environmental approval issuer, maintains the authority to oversee compliance of mining operators with issued approvals. Meanwhile, MEMR has the capacity to directly monitor mining operators on their implementation of environmental management standards — both as stipulated in the environmental approval and in accordance

with the sector specific standard set in MEMR Decree 1827, through mining operation reports that are mandatory conditions of the mining licence submitted by mining operators.

Despite this clarification from the Internal Consultation, a previous study on mining supervision implementation in several locations in East Kalimantan found that uncertainty regarding distinct supervisory authority led to a legal vacuum at the implementation level. This occurs because implementing regulations or technical provisions mandated by higher regulations are either unavailable or have yet to be stipulated. Such legal vacuums may create differing interpretations when supervising environmental management in mining areas.

Highlights and best practices in Indonesia's mining regime

(1) Integrated licensing through OSS RBA

Under Law No. 11/2020, Indonesia has established a centralised Risk-Based Business Licensing system (OSS RBA) that consolidates previously fragmented approval processes across ministries. This digital platform streamlines mining licence applications by integrating spatial utilisation, environmental and building approvals into a single workflow. The risk-based categorisation ensures that higher-risk mining operations undergo appropriate scrutiny levels, while the online system enhances transparency and reduces bureaucratic delays. This consolidated approach represents a significant advancement in regulatory efficiency and could serve as a model for other jurisdictions seeking to modernise their permitting systems.

(2) Comprehensive environmental management framework

Indonesia's environmental requirements for mining operations demonstrate robust regulatory intent. Under Law No. 4/2009 and MEMR Decree No. 69/2024, mining companies must submit comprehensive environmental documentation, with critical mineral operations requiring full Environmental Impact Assessments (AMDAL) given their high-risk designation. The framework mandates environmental deposits, reclamation commitments and post-mining restoration plans, aligning with international standards such as the Mining Policy Framework of the Intergovernmental Forum on Mining. This systematic approach to environmental stewardship provides a strong foundation for sustainable mining development.

(3) Downstreaming strategy for value addition

Indonesia's mineral processing requirements, particularly under MEMR Regulation No. 25/2018, demonstrate clear policy intent to capture greater value from domestic resources. The mandate requiring 90% completion of smelter construction before export approval, with independent verification, reflects serious commitment to domestic value addition. For nickel specifically, the prohibition on

low-grade ore exports coupled with processing requirements aims to develop local industrial capacity and generate higher economic returns from mineral extraction.

While these regulatory frameworks establish solid foundations for responsible mining governance, their ultimate effectiveness will depend on consistent implementation and the extent to which intended benefits materialise across Indonesia's diverse mining regions and communities.

Indonesia's mining regulatory framework demonstrates several progressive elements that reflect modern governance principles, though opportunities remain to maximise their effectiveness. The IEA's Critical Minerals Policy Tracker provides a helpful snapshot of the evolving supply chain governance regulations around the world. Building upon Indonesia's existing regulatory strengths and global best practices, several strategic opportunities could enhance the effectiveness and global competitiveness of the country's mining governance framework.

Opportunities

Strengthen environmental oversight through institutional coordination. Policy makers could consider clarifying institutional roles between the Ministry of Energy and Mineral Resources and the Ministry of Environment/Environmental Control Agency to enhance oversight effectiveness of mining operations. Additional regulations detailing the specific authority and coordination mechanisms between these ministries would ensure more robust supervision of mining activities throughout project lifecycles. The present regulatory framework may be updated to establish formal protocols for environmental assessment oversight, monitoring responsibilities and enforcement coordination.

- Australia's approach provides a relevant model, where environmental agencies coordinate with each other through formal memoranda of understanding that delineate responsibilities and set out joint objectives for the agencies.
- Canada's federal-provincial coordination mechanisms establish clear protocols for environmental assessment oversight between Natural Resources Canada and Environment and Climate Change Canada, reducing regulatory uncertainty whilst ensuring comprehensive communication for coordinated institutional action.

Leverage digital infrastructure for supply chain traceability. Policy makers may choose to enhance Indonesia's OSS RBA system to support mineral supply

chain traceability — a growing international requirement. The present regulatory framework may be updated to integrate OSS RBA data with the existing SIMBARA (Mining Business Information System) to create a comprehensive traceability framework linking permits, production data and export activities. In addition, policy makers may embed traceability requirements in the evaluation processes for the grant of licences and approvals. This integration would position Indonesia as potentially the first country globally to leverage mining permit data systematically for supply chain transparency.

- The Democratic Republic of the Congo has benefitted from the mineral traceability systems for conflict minerals provided by the International Tin Association's iTSCi programme. However, no jurisdiction has yet integrated permit-level data with production tracking at the scale Indonesia could achieve, providing significant competitive advantage in meeting international buyers' due diligence requirements under frameworks such as the EU Critical Raw Materials Act and the US Inflation Reduction Act.

Enhance environmental and labour standards in downstreaming industries building on the foundation of environmental standards in Indonesia. Indonesia has established environmental management frameworks for mining operations, including mandatory Environmental Impact Assessments (AMDAL) for critical minerals, environmental deposits and post-mining restoration requirements. The integrated Risk-Based Business Licensing system (OSS RBA) demonstrates commitment to regulatory efficiency and transparency. Building on these foundations, policy makers could extend similar standards to downstreaming operations to ensure consistent protection throughout the value chain. The regulatory framework for downstreaming could be enhanced by incorporating the systematic approach already applied to upstream mining activities. This may involve updating regulations to ensure downstreaming operators implement enhanced monitoring systems for health impacts, labour conditions, emissions and waste management from processing facilities. Policy makers may embed regular public reporting requirements in downstreaming approvals, creating accountability mechanisms whilst demonstrating continued commitment to responsible development. Operators may be required to establish monitoring and analysis programmes for environmental and social impacts with mandatory disclosure cycles.

- The EU Battery Regulation, for example, requires comprehensive due diligence reporting on environmental and social conditions throughout battery supply chains, including monitoring of labour conditions, environmental impacts, with economic operators required to establish risk management systems, conduct regular supply chain audits and publicly report their compliance with internationally recognised standards such as the UN Guiding Principles on Business and Human Rights.

Incentivise companies to participate in international voluntary standards. Indonesia could consider providing incentives for downstream operators to take account of internationally recognised voluntary standards, as this approach may expand Indonesia's market partnerships beyond current arrangements in the nickel and electric vehicle industries. Policy makers may update the present regulatory framework to encourage downstreaming operators to incorporate international environmental, labour and emissions standards into their operational plans and compliance strategies. Compliance with enhanced sustainability criteria could be embedded as beneficial factors in the evaluation processes for downstreaming licences and export approvals. This approach would position Indonesian operators advantageously for increased trade opportunities with key partners.

- Canada provides a strategic framework through its existing memorandum of understanding with Indonesia on critical minerals and leadership role in the Sustainable Critical Minerals Alliance, which promotes supply chain transparency underpinned by strong environmental, social and governance standards.
- The EU Critical Raw Materials Act establishes specific environmental and social criteria for critical mineral suppliers.
- Korea presents expansion opportunities through its existing nickel trade relationship and EV battery investment in Indonesia, supported by its K-ESG Guidelines for Supply Chain Management introduced in 2022.

Chapter 2. GHG Emissions in Indonesia's mineral mining regime

The relationship between GHG Emissions and mineral mining

Critical minerals are necessary to manufacture a variety of energy technologies that play a key role in decarbonisation efforts, such as wind turbines and electric vehicles. At the same time, mining itself is energy-intensive and creates GHG emissions from energy use, refining, processing, land use and deforestation, among other activities. As such, mineral mining presents both opportunities and challenges for efforts to reduce GHG emissions.

Recognising the need to address these emissions, governments around the globe have implemented regulations that seek to better quantify and limit these effects. But GHG emissions are not just a regulatory cost: they are another playing field upon which governments and industry companies are competing. Even if minerals pricing is not currently affected by GHG emissions involved in production, governments and companies are working to determine reliable GHG emissions data, to demonstrate traceability of minerals and to prepare for potential linkages of emissions intensity with trade, tax and investment mechanisms.

Indonesia has long recognised the importance of limiting GHG emissions and combatting climate change. It has been a member to the UNFCCC since 1994, ratified the Kyoto Protocol in 2004 and the Paris Agreement in 2016. As part of the Paris Agreement, Indonesia has consistently submitted its Nationally Determined Contribution (NDC) to the UNFCCC, making its most recent submission in 2022.

In 2021, Indonesia issued Government Regulations Number 98 of 2021 on the Implementation of Carbon Economic Value to Achieve Nationally Determined Contribution Targets and Control over Greenhouse Gas Emissions in Relation to National Development ("GR 98/2021"), a landmark presidential regulation that established a framework for GHG pricing in Indonesia. However, the regulatory landscape for mining sector GHG emissions is not as robust as it is in other sectors, despite the role that minerals will play in Indonesia's efforts to reach net zero emissions.

Regulation of GHG Emissions in the Mining Sector

Much of Indonesia's existing regulatory framework does not address GHG emissions in the mining sector. For example, PR 98/2021 does not apply to the mining sector. Instead, it only applies to specific sectors such as, power generation, transportation, building and industry (within the sector of energy and mineral resources); waste, liquid waste and solid waste (within the sector of environmental protection and management); rice fields, livestock and plantations (within the sector of agriculture); and forestry, peat and mangrove management (within the sector of forestry). This means that the mining sector cannot directly participate in domestic and foreign carbon markets under PR 98/2021, although the mining sector is nevertheless subject to other environmental regulations.

The mining sector is regulated by sector-specific regulations, principally MEMR Reg 22/2019. That regulation establishes Indonesia's GHG inventorying strategy for the energy sector. MEMR 22/2019's definition of GHG emissions includes emissions originating from methane gas released from coal layers during coal mining activities (coal mine methane), among other non-mining sources. However, MEMR Reg 22/2019 does not account for other mining emissions.

Under MEMR Reg 22/2019, GHG emission inventory is calculated by multiplying MEMR data on the number of GHG-emitting activities with an emissions factor, namely the estimated amount of GHG emissions released into the atmosphere per unit of activity. The regulation provides for three tiers of emissions inventory calculation. In Tier 1, the emissions factor is based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories ("IPCC-2006 guidelines"). In Tier 2, the emissions factor may be higher than Tier 1 based on parameters set out by MEMR. In Tier 3, the emissions factor may be higher than it would be in Tier 2 in accordance with the advancement of the technology (i.e. the discovery of a more accurate parameter).

MEMR Reg 22/2019 Emissions Inventory Calculations

Category	Calculation method: multiplication of current year activity data by GHG emissions factor
Tier 1: Simplest approach	• Activity data includes energy sector data on fuel consumption, fugitive data and data on transportation of carbon dioxide. • Emissions factor is determined by the Intergovernmental Panel on Climate Change-2006 (IPCC-2006).
Tier 2: Medium level of accuracy	• Activity data is calculated as in Tier 1 • Emissions factor is determined by the Minister of Energy and Mineral Resources.

Tier 3: Complex level of accuracy	• Activity data is calculated as in Tier 1 • Emissions factor is calculated in accordance with available tools and technology

Source: IEA Analysis, MEMR Reg 22/2019.

As part of the Internal Consultation, MEMR indicated that Indonesia is focusing on establishing coal mine methane emissions using Tier 1 calculation mechanism. This calculation involves the multiplication of national coal mining data by the emissions factor set out in IPCC-2006. MEMR also indicated that it is drafting its own emissions factor that would enable tier 2 calculations.

Highlights and best practices in Indonesia for implementing GHG emissions regulations in mining

(1) Climate targets and commitments

Indonesia has committed to reach net zero emissions by 2060 or earlier in its long-term scenarios. In addition, it has set an unconditional emissions reduction target of 31.89% and a conditional reduction target of 43.20% by 2030, relative to a business-as-usual baseline. While the NDC does not include sector-specific reduction targets for mining, these overarching targets provide the foundation for developing sector-specific policies to achieve emissions reduction.

(2) Efforts to transform the energy mix

Efforts to change the shares of fuels in the country's energy mix are being made, including through Government Regulation No. 79/2014. The regulation envisions the share of fossil fuels reduced to 77% in 2025 (comprised of 25% oil, 30% coal and 22% gas), further reduced to 69% by 2050 (with 20% oil, 25% coal and 24% gas). These targets to decarbonise the country's energy sources are essential to ensure emissions reduction in the production and processing of minerals.

(3) Monitoring and reporting obligations

Legal instruments such as GR 22/2021 and Regulation of the Minister of Environment and Forestry Number 4 of 2014 require mining operators to monitor emissions and air quality from mining activities as per set standards. These obligations are a critical starting point for achieving emissions control in the mining sector.

(4) Implementation of a GHG inventory

MEMR Reg 22/2019 enables inventorying of GHG emissions in the mining sector, including establishing a definition of GHG emissions that will be accounted for. The regulation also enables a flexible calculation scheme that reflects technological

progress and MEMR's evolving capacity to determine more accurate emissions factors.

Opportunities

Expand MEMR GHG emissions regulations to cover mineral mining. Given that PR 98/2021 does not cover mining and MEMR Reg 22/2019 only covers coal mine methane, there is an opportunity to regulate the GHG emissions from mineral mining. MEMR Reg 22/2019 provides a strong foundation for expansion to the mineral mining sector, since it already creates an effective calculation mechanism for power generation and other energy sector emissions sources. As demand for key minerals continues to grow, consumers and investors increasingly demand that manufacturers source minerals that are sustainably and responsibly produced. Given the projected increase in mineral mining, requiring GHG emissions reporting for mineral mining can boost countries' visibility into their emissions profiles. During the Internal Consultation, MEMR indicated that mineral mining companies may be required to submit an emissions inventory report in the future. However, a revision to MEMR 22/2019 might be required to expand the definition of GHG emissions to include those from mineral mining activity.

- Canada's Greenhouse Gas Reporting program requires facilities that emit 10 kilotons or more of CO_2e to submit a GHG emissions report and compels mining operators to provide additional data and apply specific quantification methods when determining their emissions.

- Australia's GHG emissions reporting framework is similar, requiring facilities that meet certain thresholds to register under the framework and report on annual GHG emissions, energy production and consumption.

Develop sectoral targets for GHG emissions reduction. While Indonesia has economy-wide emissions reduction commitments, these have not yet been translated into sector-specific targets for mining operations. Policy makers could consider establishing nationwide sectoral targets for mining operations as a foundational step, providing clear direction for the industry's contribution to national climate goals. Once sectoral targets are established, companies could then be encouraged to develop site-specific emissions reduction targets that align with and contribute to the broader sectoral objectives. Currently, regulations do not specify required emissions monitoring or reporting methodologies for mining operations, site-specific emissions reduction targets or technology standards for emissions control or clean energy requirements for mining operations. Developing initial mining sector GHG emissions goals would provide a baseline for additional

regulations and create a framework within which individual operators can establish their own reduction pathways.

- Chile, the world's biggest producer of mined copper, aims for a 2.38 $MtCO_2eq$ reduction in GHG emissions by 2030 in the industry and mining sector. As part of its 2020 NDC submission, it incorporated scenarios setting out GHG reductions of 57% in open-pit copper mines, 74% in underground copper mining and 52% in other copper mining activities to achieve carbon neutrality by 2050. Chile's National Mining Policy 2050, a strategic roadmap to promote sustainable mining, also calls for the mining sector to achieve carbon neutrality by 2040.

Develop comprehensive data accuracy and transparency mechanisms. Continue development of Tier 2 emissions factors, as Tier 1 is the least accurate mechanism of GHG emissions calculation in MEMR's three-tiered scheme and moving to Tiers 2 or 3 can pinpoint actual emissions levels with greater precision. MEMR has indicated that it is currently developing Tier 2 emissions for coal mining operations. If MEMR 22/2019 is expanded to include mineral mining, MEMR may also consider developing a specific emissions factor for mineral mining emissions to facilitate more accurate data reporting. Accurate emissions reporting strengthens the credibility of GHG inventories, supports commitments to climate progress and enables policy makers to make informed regulatory decisions. Eventually, it may be desirable to use third-party auditing to support verification of GHG emissions data. Improved data transparency can help increase the impact of data reporting by facilitating access by governments, investors and other stakeholders.

Build groundwork for mining sector integration into future carbon pricing mechanisms. Once robust emissions reporting, reduction targets and accurate measurement systems are in place for the mining sector, policy makers could consider how mining operations might be integrated into Indonesia's evolving carbon pricing framework. GR 22/2021 provides a foundation for carbon pricing mechanisms and enables Ministerial Regulations to realise sector-specific systems. Establishing compatible GHG accounting and reporting systems in mining would ensure the sector can be seamlessly incorporated into any future nationwide carbon pricing mechanism. Currently, there are no specific provisions governing how this will be implemented for mineral and coal mining activities, requiring additional regulatory development to establish mining sector compatibility with broader climate policy instruments. The energy sector provides a reference point — MEMR Reg 22/2019 stipulates that GHG emissions reporting will support the implementation of GHG emission quotas, among other goals. If Indonesia pursues carbon pricing mechanisms that include mining, lessons from international experience should inform design choices. Most countries have opted to initially provide emission units allowance in mining operations for free. Allocation

can be based on grandfathering methods (allowance based on the past emission record of each business or activity) or through benchmarking (allowance based on an emissions benchmark set for each business or activity sector).

- In Kazakhstan's emissions trading scheme, none of the participating mining companies exceeded their emissions quotas between 2018 and 2020, suggesting initial mining sector quotas were too generous.

Chapter 3. Mine waste in Indonesia's mining regime

Defining mine waste

Mine waste refers to the materials generated during the extraction and processing of ore into a commercially viable concentrate, including waste rock, tailings and mine drainage water. Management of most mine waste in Indonesia is governed in accordance with the prevailing regulations on management of toxic and hazardous waste (*Limbah Bahan Berbahaya Beracun* or "B3 Waste"). Article 1 (22, 23) of Law No. 32/2009 defines B3 waste as any waste containing hazardous and toxic materials. In general, this is waste which contains a substance that due to its characteristics, concentration or quantities, may either directly or indirectly pollute and/or damage the environment or harm the environment, health, as well as the life sustainability of humans and other living organisms.

The substances that are considered as B3 Waste in Indonesia are listed in Attachment IX to Government Regulation Number 22 of 2021 concerning Environmental Protection, Organisation and Management ("GR 22/2021"). This list includes several categories of mine waste, notably excluding overburden and wastewater. During the Internal Consultation, the Ministry of Environment confirmed that these categories of mine waste are considered B3 waste.

List of mining waste determined as B3 waste in Indonesia

Table 3	Activity 28: Mining
	A331-1: Spent process solutions (CN)
	A331-2: Sludge from oil treatment or storage facilities
	B331-1: Waste from fire assay processes such as ceramic, flux, and cuppel
	B331-2: Sludge and/or filter cakes from gas treatment
	B231-3: Dust from air pollution control facility

Source: Attachment IX PP 22/2021, Ministry of Environment, Indonesia (2025).

Regulating B3 Mine Waste

Mine waste characterised as B3 waste is governed by the Ministry of Environment in accordance with the provisions of GR 22/2021 and its implementing regulations, the Minister of Environment and Forestry's Regulation Number 6 of 2021 on Procedure and Requirements for the Management of Hazardous and Toxic Waste ("MoEF Reg 6/2021").

In addition, Law Number 32 of 2009 on the Protection and Management of the Environment ("Law 32/2009") provides that any person who produces B3 Waste must carry out B3 Waste management, which includes, among others, waste reduction, waste storage, waste collection, waste transportation, waste utilisation, waste processing, waste stockpiling and waste dumping. Specifications for the implementation of B3 Waste management are set out in MoEF Reg 6/2021.

Stockpiling

On stockpiling of mining waste, MoEF 6/2021 stipulates that B3 waste originating from mineral ore smelting and mineral ore processing or refining may be stockpiled through replacement of such waste in the former mining area, either in a surface mining shaft or underground mining shaft. B3 waste in the form of tailings can be stockpiled in mining waste storage dams. The implementation of mine waste stockpiling must meet the technical requirements stipulated in MoEF 6/2021, including the need for a waste disposal plan and a closure and post-closure plan for the stockpiling facility.

In addition, MEMR Decree 1827 states that tailings dams must be designed, built and operated such that they are safe and do not cause pollution to surface and ground water. Further, the guidelines state that tailings dams should be equipped with an emergency response system and a structural failure mitigation plan.

Dumping

MoEF 6/2021 also permits and regulates the dumping of certain waste into the sea, making Indonesia one of the few states that still allow this practice. Waste that can be dumped into the sea includes: (a) tailings; (b) drilling dust from exploration or exploitation activity using synthetic-based mud; and (c) non-B3 waste in the form of drilling dust or drilling mud from exploration or exploitation activity using water-based mud.

As per the regulation, waste producers must obtain an approval from the central government and ensure that the following requirements have been met to conduct waste dumping: (a) waste requirements before dumping, wherein waste undergoing dumping must be neutralised or have reduced toxicity levels; (b)

dumping location requirements, including that the baseline sea quality of the dumping location meets the prevailing sea water quality standards; (c) dumping procedures; and (d) environmental monitoring of the sea water quality and impact on marine sediments and marine ecosystems.

The central government has not granted licences for the dumping of mining waste in the sea in the last few years.

Monitoring and Reporting

MOEF Reg 6/2021 also requires producers, collectors, utilisers, processors and stockpilers of B3 waste to monitor B3 Waste storage activities. Monitoring includes inspecting waste storage facilities (such as, relocation in former mines, dams, injection wells etc.), supervising the collection of waste, recording the incoming and outgoing waste from a facility and routinely reporting data to the authorities (including about the type and amount of B3 Waste produced, stored and submitted to collectors, utilisers and processors).

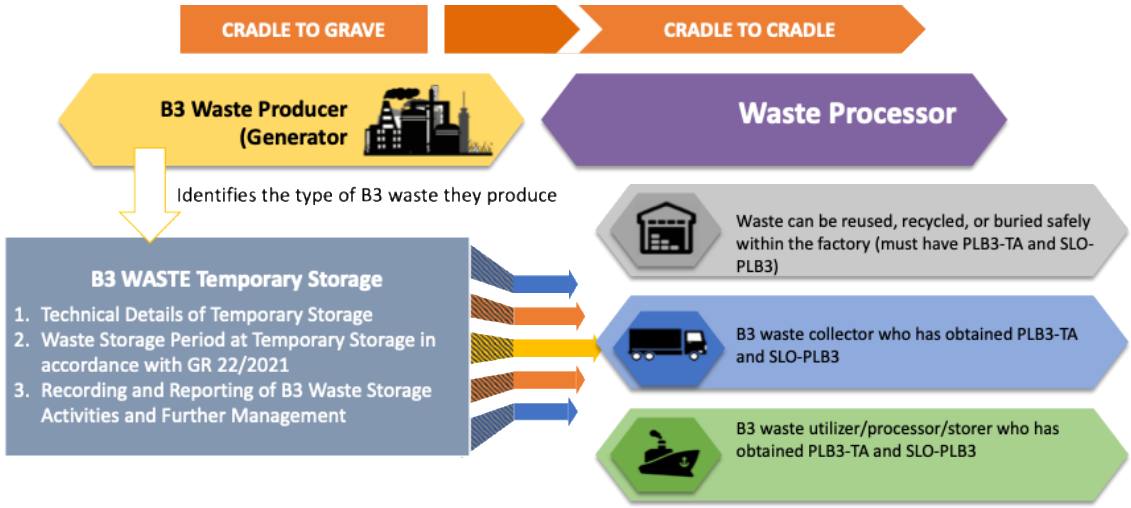
Licensing

In addition, MoEF Reg 6/2021 provides that businesses that conduct B3 Waste management must obtain technical approvals as a prerequisite to the Environmental Approval. There are two types of technical approvals that need to be obtained to conduct B3 Waste management:

- Technical Approval (*Persetujuan Teknis di Bidang Pengelolaan Limbah B3* or "PLB3 TA");
- Certificate of Operational Feasibility (*Surat Kelayakan Operational di bidang Pengelolaan Limbah B3* or "SLO-PLB3").

B3 Waste management activity in the form of waste collection, waste utilisation, waste processing and waste stockpiling must be equipped with both PLB3 TA and SLO-PLB3, while B3 Waste management activity in the form of waste dumping need only be equipped with PLB3 TA.

B3 Waste management in accordance with the prevailing regulations



Source: Ministry of Environment, Indonesia (2025)

Implementation and Monitoring of Mine Waste Management

As set out above, the monitoring and supervision of B3 mine waste management falls under the authority of the Ministry of Environment, as they implement GR 22/2021, MoEF Reg 6/2021 and Law 32/2009. In addition, the Ministry of Environment also regulates the management of wastewater from mining.[12]

However, as established in Chapter 1, MEMR also has supervision on mine waste management based on MEMR Decree 1827, which provides technical guidelines in the form of standard operating procedures for the environmental management of mineral and coal mining operations. Illustratively, in relation to overburden stockpiling, MEMR Decree 1827 stipulates prioritising the refilling of former mining holes with a view to mineral conservation. If overburden stockpiling is carried out outside the mining site, it must be in accordance with a safe distance assessment

[12] Relevant regulations on mining wastewater management include:
- Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management,
- Regulation No. 5 of 2022 on Wastewater Processing for Mining Businesses and/or Activities by Using Constructed Wetland Methods,
- Regulation of the State Minister of Environment No. 09 of 2006 on Wastewater Quality Standard for Nickel Ore Mining Businesses and/or Activities,
- Regulation of the State Minister of Environment No. 202 of 2004 on Wastewater Quality Standard for Gold and or Copper Ore Mining Businesses and/or Activities,
- Regulation of the State Minister of Environment No. 34 of 2009 on Wastewater Quality Standard for Bauxite Ore Mining Businesses and/or Activities.

from residential buildings, public facilities, public water bodies, agricultural land and plantations.

In addition, MEMR also implements Government Regulation Number 78 of 2010 on Reclamation and Post-Mining ("GR 78/2010") that sets out obligations for mining licence holders to conduct reclamation and post-mining after the expiration of their mining licence. Licence holders are required to submit a reclamation and post-mining plan for approval, deposit guarantee funds for the implementation of their plans and report on the implementation of the plans routinely. Relevant authorities conduct evaluation of the implementation based on the reports submitted by the licence holders.

As confirmed during the Internal Consultation, MEMR regulates mine waste management from the perspective of resource conservation, since mine waste is considered to have strategic importance based on the quality and quantity of resources that can be recovered from it. Moreover, the Ministry of Public Works confirmed that it ensures that mine waste is stored in dam-like structures, such as tailings dams. In such cases, an approval is required from the National Dam Safety Commission for the construction and operation of the dam. The Ministry also oversees the submission and implementation of emergency plans for dams.

Highlights and best practices in Indonesia for mine waste management

(1) Foundational general obligations on mining waste producers

Law Number 32 of 2009 on the Protection and Management of the Environment obligates producers of B3 Waste to carry out B3 Waste management, including waste storage, collection, transportation, utilisation, processing, stockpiling and dumping. For mine waste characterised as B3 Waste, this provides a foundational legal framework for ensuring mine waste management.

(2) Technical regulatory requirements for waste stockpiling

Regulation Number 6 of 2021 lays down technical requirements that must be met by mining waste storage facilities, including the need for plans for waste disposal, closure and post-closure. In combination with the requirement for emergency response systems and structural failure mitigation plans in MEMR Decree 1827 and the technical requirements for dam safety implemented by the Ministry of Public Works, mine waste stockpiling is robustly regulated in law.

(3) Monitoring obligations for waste stockpiling

Regulation Number 6 of 2021 requires producers, collectors, utilisers, processors and stockpilers of B3 waste to monitor B3 Waste storage activities, including *inter alia* inspection of facilities, supervision over waste movement, testing of water samples and reporting to authorities. This aligns with best practices in relation to

mine waste management, providing a basis for authorities to implement standards, conduct inspections and enforce environmentally sound waste management.

Mining Waste Recycling

Sometimes, there are minerals left within mine waste that have low economic value at the time of extraction and are not considered financially feasible to recover. However, the advancement of technology and the rising price of mineral products has resulted in mining waste recycling becoming both a viable and attractive action to be taken by mining operators.

There is no specific regulation that regulates mine waste recycling in Indonesia, as confirmed by the MEMR and the Ministry of Environment during the Internal Consultation. That said, MEMR conveyed during the Internal Consultation that mining operators are encouraged to recycle mine waste as part of its activities within the Operation and Production Licence.

In addition, MoEF 6/2021 regulates “B3 waste utilisation” that is defined to mean the act of using recovery and/or recycling to change B3 waste into products that can be used as substitutes for raw materials, auxiliary materials and/or fuels that are safe for human health and the environment. The regulations lay down detailed technical standards that are required to be met for waste utilisation. Further, waste utilisation activities may be implemented only upon a utilisation plan being submitted to the Ministry of Environment. The utilisation plan should include copies of the technical approvals (PLB3 TA and SLO-PLB3) and a flowchart of the utilisation process that at least contains information about the amount of B3 waste utilised and the implementation period of waste utilisation activities.

Opportunities

Strengthen regulatory framework and enhance inter-agency coordination for mine waste management. Indonesia's mine waste management operates under a complex regulatory landscape spanning waste legislation, mining regulations and technical approval requirements. Consolidating this framework through unified guidance documents would clarify the treatment of mine waste as economically viable material with defined hazard characteristics, specifying applicable standards and approval processes at each operational stage. In addition, an inter-agency coordination mechanism involving the Ministry of Energy and Mineral Resources, Ministry of Environment, and Ministry of Public Works would leverage complementary expertise whilst reducing regulatory overlap.

- For example, Ontario's proposed Mining Act amendments allow streamlined recovery permit applications with integrated remediation planning, replacing multiple approval processes.
- The Philippines has established an inter-agency one-stop shop for all mining related applications and processes that demonstrates coordination among agencies.
- The US Federal Mining Dialogue also provides an example of a structured forum for federal agency coordination on abandoned mining sites.

Establish comprehensive waste mapping and resource assessment systems. Building on MOEF Regulation 6/2021's monitoring requirements, a national mine waste mapping system would facilitate resource recovery by providing accessible information on waste locations, mineral content and recovery potential. Integration with existing platforms could support government initiatives to develop the mine waste ecosystem: integration with the MEMR One Map Indonesia platform would leverage established infrastructure whilst expanding data scope to include detailed resource estimation; and integration with SIMBARA may support optimisation in valuing mine waste. These efforts may be supplemented by a clear strategic plan that provides guidance on assessing mineral content in waste materials and helps operators determine the feasibility and cost-benefit of resource recovery.

- Geoscience Australia's Atlas of Australian Re-mining Potential illustrates the value of comprehensive mapping, cataloguing over 1,000 sites with detailed information on tailings, waste rock and smelter residues.
- Similarly, Chile's public tailings platform centralises nationwide deposit information, including resource characteristics at each location.
- The US Geological Survey's USD 5 million investment in mine waste mineral extraction data collection demonstrates the funding scales required for effective resource assessment programmes.

Create economic incentives and targeted financial support for mine waste recovery. A structured incentive framework combining regulatory fees, tax adjustments and direct financial support would address economic barriers to mine waste recovery. Fee structures per unit of mine waste produced, as implemented in the Philippines, could be offset by reductions tied to mineral recovery activities. Royalty adjustments on primary commodities based on waste site resource evaluation or R&D activities would encourage extraction efficiency improvements. Expanding exploration tax credits to include mine waste recovery expenditures, following Canada's Critical Mineral Exploration Tax Credit model, would support resource identification activities. Direct financial support for technology innovation,

R&D and workforce development addresses the substantial upfront investments required for recovery infrastructure.

- Queensland, Australia announced an AUD 5 million funding programme for mining waste value recovery under the Critical Minerals Strategy as a targeted approach to technology development.
- India's National Critical Mineral Mission has allocated INR 1 billion for pilot recovery projects and INR 15 billion for recycling facilities demonstrates comprehensive support structures.
- The United States announced a USD 5 million funding opportunity to support state-led efforts in identifying critical minerals in mine waste, aiming to build a national inventory and modernise geological data.

Develop contextualised best practices for mine waste disposal and strengthen waste reduction. Indonesia's diverse geographical and community contexts require locally adapted guidance on safe mine waste disposal practices. Adapting international standards from the International Council on Mining and Metals (ICMM) and Global Tailings Review to Indonesian conditions, through consultation with industry experts (e.g. the Nickel Institute), local and international civil society organisations and affected communities, would provide practical implementation guidance. This approach aligns with recommendations from the UN Secretary General's Panel on Critical Energy Transition Minerals for context-specific solutions. Integrating waste reduction principles throughout regulatory processes, from environmental documentation to disposal planning, would also strengthen prevention measures.

- The EU's Extractive Waste Directive requirements for submission of waste management plans with prevention and minimisation objectives, demonstrate how waste reduction criteria may be embedded in licensing evaluations.

Abbreviations and acronyms

AMDAL	Environmental Impact Analysis (*Analisis Mengenai Dampak Lingkungan)*
B3 Waste	Toxic and Hazardous Waste (*Limbah Bahan Berbahaya Beracun*)
GR 22/2021	Government Regulations Number 22 of 2021 on Implementation of Environmental Protection and Management
GR 22/2021	Government Regulations Number 22 of 2021 concerning Environmental Protection, Organisation, and Management
Law 11/1967	Law Number 11 of 1967 concerning Basic Provisions on Mining
Law 4/2009	Law Number 4 of 2009 concerning Mineral and Coal Mining
MEMR	Ministry of Mineral and Energy Resources
MEMR Decree 1827	MEMR Decree Number 1827 K/30/MEM/2018 of 2018 concerning Guidelines for the Implementation of Good Mining Governance
MEMR Decree 69/2024	MEMR Decree Number 69.k/MB.01/MEM.B/2024 concerning Stipulation of Types of Commodities Classified in Strategic Mineral
MEMR Reg 22/2019	MEMR Regulation Number 22 of 2019 on Guidelines for the Implementation of GHG Inventory and Mitigation for Energy Sectors
MEMR Reg 26/2018	MEMR Regulations Number 26 of 2018 concerning to Implementation of Good Mining Principle
MoEF Reg 21/2022	Ministry of Environment and Forestry Regulations Number 21/2022 on the procedure for the application of carbon economic value
MoEF Reg 6/2021	Minister of Environment and Forestry Number 6 of 2021 on Procedure and Requirements for the Management of Hazardous and Toxic Waste
NIB	Nomor Induk Berusaha
OSS RBA	Online Single Submission Risk-Based Approach
PLB3 TA	Technical Approval in the field of B3 Waste Management (*Persetujuan Teknis di Bidang Pengelolaan Limbah B3)*
PR 98/2021	Presidential Regulations Number 98 of 2021 on the Implementation of Carbon Economic Value to Achieve Nationally Determined Contribution Targets and Control over Greenhouse Gas Emission in Relation to National Development
REE	Rare Earth Elements

SLO-PLB3	Certificate of Operational Feasibility in the field of B3 Waste Management (*Surat Kelayakan Operational di bidang Pengelolaan Limbah B3*)
SPPL	Statement of Capability in Environmental Management and Monitoring (*Surat Pernyataan Kesanggupan Pengelolaan dan Pemantauan Lingkungan*)
UKL-UPL	Environmental Management Efforts and Environmental Monitoring Efforts (*Upaya Pengelolaan Lingkungan dan Upaya Pemantauan Lingkungan*)
WUP	Wilayah Usaha Pertambangan

Annex

Historical Changes to Indonesia's Mining Regulation

	Law 11/1967 as amended	Law 4/2009 as amended
Classification of Minerals	Minerals are classified based on its economic value such as: • Class A Strategic Mineral • Class B Vital Mineral • Class C non-Strategic and non-Vital mineral	Minerals are classified in accordance with its characteristic into 5 categories: • Radioactive Mineral • Metal Mineral • Non-Metal Mineral • Rocks • Coal
Mining territory	Law 11/1967 lacks specific provisions regarding mining territories.	Law 4/2009 provides stipulation of mining territory with specific designation on the type of mining business which can be conducted in the respective mining territory, as elaborated in the subsequent section of this report.
Mining Business Activities	• General investigations • Exploration • Exploitation • Processing • Refinery • Transportation • Sales of mining products	• Mining exploration, which encompasses activities of general investigation, exploration, and feasibility studies • Mining Production and Operation, which encompasses activities of construction, mining, processing and refinery, enrichment or utilisation, and transportation and sales of mining products

Basis for conducting mining business activities	• Mining Authorisation, which may be granted based on application from eligible entity.
	• COW, a contractual agreement between the state and private entity
		• Mining Licence and allocation of WIUP, which are granted through the following procedure:
		  • Auction for metal mineral and coal mining,
		  • Application from eligible subject for non-metal mineral mining.
		• Special Mining and allocation of WIUPK, which are granted through tender offers (for state or regional owned enterprise) or auction (for private party)
		• Community Mining Licence

	Law 11/1967 as amended	Law 4/2009 as amended
Rights and Obligations	• For mining authorisation, in accordance with the rights and obligations under Law 11/1967 and other relevant prevailing regulations. • For COW, in accordance with the contractual rights and obligations under COW.	The rights and obligations of any person conducting mining business activities are as regulated in Law 4/2009 and other relevant prevailing regulations.

Source: IEA Analysis (2025).