

Sustainability in Mineral Economics

Acid Mine Drainage (AMD)

Related terms: water quality, tailings, remediation

Definition: The outflow of acidic water from mine sites caused by oxidation of sulfide minerals, leading to environmental degradation. Example: A copper mine in Chile releases AMD that lowers river pH, affecting aquatic life. Practical application: Use of limestone drains and constructed wetlands to neutralize acidity.

Challenges: Long-term monitoring and high remediation costs.

Adaptive Management

Related terms: feedback loops, sustainability, policy

Definition: A systematic approach for improving resource management by learning from outcomes and adjusting strategies. Example: A mining company revises its water-use plan after seasonal drought data.

Practical application: Incorporating real-time monitoring data into operational decisions. Challenges:

Requires flexible governance and stakeholder engagement.

Aluminium Production Footprint

Related terms: energy intensity, greenhouse gases, recycling

Definition: The total environmental impact associated with extracting bauxite, refining alumina, and smelting aluminium, including emissions and resource use. Example: Assessing the carbon intensity of a smelter in Iceland. Practical application: Implementing renewable energy contracts to lower the footprint.

Challenges: High electricity demand and volatile energy markets.

Alternative Minerals

Related terms: criticality, substitution, supply risk

Definition: Minerals that can replace traditional resources in specific applications, reducing dependence on scarce or geopolitically sensitive commodities. Example: Using graphite as a substitute for lithium in certain battery technologies. Practical application: R&D programs to test performance of alternative materials.

Challenges: Technical feasibility and market acceptance.

Anthropogenic Climate Change

Related terms: global warming, carbon budget, mitigation

Definition: Human-induced alterations to the climate system, primarily through greenhouse gas emissions from industrial activities, including mining. Example: Increased frequency of extreme weather events affecting mine logistics. Practical application: Setting emission reduction targets aligned with the Paris Agreement.

Challenges: Balancing economic growth with climate commitments.

Asset Valuation under ESG

Related terms: environmental, social, governance, risk assessment

Definition: The process of incorporating environmental, social, and governance factors into the financial valuation of mineral assets. Example: Adjusting discount rates for a gold project based on its

water-management plan. Practical application: Using ESG-adjusted cash-flow models for investment decisions. Challenges: Data availability and standardisation of ESG metrics.

Bio-leaching

Related terms: hydrometallurgy, microorganisms, low-grade ore

Definition: The extraction of metals from ores using living organisms, often bacteria that oxidise sulfide minerals. Example: Application of **Acidithiobacillus ferrooxidans** to recover copper from tailings. Practical application: Reducing energy consumption compared with traditional pyrometallurgy. Challenges: Process control, time-intensive operations, and regulatory approval.

Carbon Capture and Storage (CCS)

Related terms: CO₂ sequestration, emissions trading, geological storage

Definition: Technologies that capture carbon dioxide from industrial processes and store it underground to prevent atmospheric release. Example: A coal-fired power plant adjacent to a mine integrates CCS to lower its carbon intensity. Practical application: Leveraging carbon credits to finance CCS projects. Challenges: High capital costs and public acceptance of storage sites.

Carbon Neutrality

Related terms: net-zero, offsetting, renewable energy

Definition: Achieving a balance between emitted and removed greenhouse gases, resulting in no net increase in atmospheric CO₂. Example: A mining firm purchases renewable energy certificates to offset its emissions. Practical application: Developing internal carbon pricing to incentivise low-carbon operations. Challenges: Accurate accounting of indirect emissions and reliable offsets.

Circular Economy

Related terms: resource efficiency, recycling, waste minimisation

Definition: An economic model that prioritises keeping resources in use for as long as possible through reuse, refurbishment, and recycling. Example: Re-processing tailings to recover residual copper and cobalt. Practical application: Designing products for easy disassembly and material recovery. Challenges: Technological barriers and market demand for secondary materials.

Closed-Loop Water Management

Related terms: recycling, desalination, water footprint

Definition: A system where water is continually reused within the mining process, minimising fresh-water intake and discharge. Example: Using brine from ore processing for cooling towers after treatment. Practical application: Installing membrane filtration to achieve high recovery rates. Challenges: Managing contaminants and maintaining water quality standards.

Community Development Agreements (CDAs)

Related terms: social licence, stakeholder engagement, benefit sharing

Definition: Formal contracts between mining companies and local communities outlining development projects, employment, and environmental safeguards. Example: A CDA in Ghana includes funding for local schools and health clinics. Practical application: Monitoring compliance through joint community-company committees. Challenges: Aligning expectations and ensuring long-term benefits.

Compliance Auditing

Related terms: regulatory frameworks, ISO standards, internal controls

Definition: Systematic review of a company's adherence to legal, environmental, and safety regulations.

Example: Annual audits of tailings dam safety against national standards. Practical application: Using third-party auditors to provide independent verification. Challenges: Resource intensity and keeping up with evolving regulations.

Conservation Banking

Related terms: biodiversity offsets, habitat restoration, ecological credits

Definition: The creation of protected areas that generate ecological credits, which can be purchased to offset environmental impacts elsewhere. Example: A mining project funds a conservation bank to protect wetlands in the same watershed. Practical application: Integrating offsets into the project's environmental impact assessment. Challenges: Measuring equivalence of ecological functions and ensuring permanence.

Corporate Social Responsibility (CSR)

Related terms: ethical mining, stakeholder trust, sustainability reporting

Definition: Corporate initiatives that contribute to societal goals, often beyond legal requirements, focusing on environmental stewardship and community welfare. Example: Publishing an annual sustainability report aligned with GRI standards. Practical application: Implementing community-led monitoring of water quality. Challenges: Avoiding "green-washing" and aligning CSR with core business strategy.

Critical Minerals

Related terms: strategic importance, supply chain risk, diversification

Definition: Minerals essential for modern technologies and national security, where supply risk is high.

Example: Rare earth elements used in wind-turbine magnets. Practical application: Investing in domestic exploration to reduce import dependence. Challenges: Geopolitical tensions and limited global reserves.

Cut-off Grade Optimization

Related terms: resource modeling, economic feasibility, ore grade

Definition: Determining the lowest ore grade that can be processed profitably, balancing extraction costs against market prices. Example: Adjusting the cut-off grade for a nickel deposit after a price surge. Practical application: Using software to model varying cut-off scenarios. Challenges: Uncertainty in price forecasts and processing technology changes.

Decarbonisation Roadmap

Related terms: emission targets, technology transition, stakeholder alignment

Definition: A strategic plan outlining steps for reducing carbon emissions across a mining operation's lifecycle. Example: A roadmap that phases out diesel generators in favour of electric vehicles. Practical application: Setting interim milestones for renewable-energy integration. Challenges: Capital investment timing and supply chain constraints.

Demand-Side Management

Related terms: energy efficiency, market incentives, load shifting

Definition: Strategies aimed at influencing consumer demand for minerals to promote sustainable

consumption patterns. Example: Incentivising recycled aluminium in automotive manufacturing. Practical application: Collaborating with downstream users to develop design standards. Challenges: Changing entrenched procurement habits and price elasticity.

Ecological Footprint

Related terms: land use, biodiversity impact, sustainability metrics

Definition: A measure of the biologically productive area required to support a mining operation's resource consumption and waste generation. Example: Calculating the footprint of a copper mine based on water use and tailings area. Practical application: Using the metric to benchmark against industry averages.

Challenges: Data collection across supply chains and translating results into actionable targets.

Economic Viability Assessment

Related terms: NPV, discount rate, sensitivity analysis

Definition: Evaluation of whether a mining project can generate sufficient financial returns under various scenarios. Example: Conducting a sensitivity analysis for a lithium project under different battery-price forecasts. Practical application: Integrating ESG risk premiums into cash-flow models. Challenges:

Uncertainty in commodity prices and regulatory changes.

Environmental Impact Assessment (EIA)

Related terms: baseline study, mitigation measures, public consultation

Definition: A systematic process to predict the environmental consequences of a proposed mining activity and propose mitigation. Example: An EIA for a new open-pit mine includes wildlife corridor design. Practical application: Using GIS tools to map potential impacts. Challenges: Ensuring comprehensive baseline data and meeting stakeholder expectations.

Environmental, Social and Governance (ESG) Integration

Related terms: investment criteria, risk management, reporting standards

Definition: Incorporating ESG considerations into decision-making, financing, and performance tracking of mineral projects. Example: An ESG score influences the allocation of capital to a cobalt mine. Practical application: Aligning project KPIs with UN Sustainable Development Goals. Challenges: Lack of comparable ESG data across jurisdictions.

Externalities

Related terms: social cost, pollution, market failure

Definition: Costs or benefits arising from mining activities that affect third parties and are not reflected in market prices. Example: Airborne dust affecting nearby agricultural yields. Practical application: Internalising externalities through taxes or compensation schemes. Challenges: Quantifying non-market impacts and negotiating fair compensation.

Feasibility Study

Related terms: technical assessment, financial modelling, risk analysis

Definition: A comprehensive evaluation of the technical and economic parameters of a mining project before investment. Example: A prefeasibility study for a rare-earth deposit includes pilot plant testing.

Practical application: Using the study to secure financing from banks. Challenges: Data uncertainty and

changing regulatory environments.

Fine-Grained Tailings Management

Related terms: settlement, dam stability, reclamation

Definition: Strategies for handling fine particles in tailings to prevent liquefaction and ensure long-term stability. Example: Using thickened tailings to reduce water content before storage. Practical application: Implementing real-time monitoring of tailings pore pressure. Challenges: Balancing cost with safety and environmental standards.

Financial Disclosure Standards

Related terms: IFRS, SASB, sustainability reporting

Definition: Guidelines for reporting financial and ESG information to investors and regulators. Example: A mining company adopts the IFRS S1 Climate-Related Disclosures. Practical application: Aligning reporting processes with audit cycles. Challenges: Keeping up with evolving standards and ensuring data integrity.

Geopolitical Risk Assessment

Related terms: political stability, trade policies, sanctions

Definition: Analysis of how political and diplomatic factors could affect mineral supply chains and project execution. Example: Assessing the impact of new export restrictions on rare-earths from a particular country. Practical application: Diversifying sourcing to mitigate concentration risk. Challenges: Rapidly changing international relations and limited predictive models.

Green Mining

Related terms: low-impact extraction, renewable energy, waste reduction

Definition: Mining practices that minimise environmental harm through energy efficiency, reduced emissions, and responsible waste handling. Example: A gold mine powered entirely by solar panels. Practical application: Conducting life-cycle assessments to identify hotspots. Challenges: High upfront costs and technology adaptation in remote locations.

Groundwater Modelling

Related terms: hydrogeology, contaminant transport, numerical simulation

Definition: Computational tools used to predict the movement of water and solutes beneath the earth's surface around mining sites. Example: Modelling the spread of arsenic from a former uranium mine. Practical application: Designing mitigation wells to intercept contaminant plumes. Challenges: Data scarcity and uncertainty in geological parameters.

Habitat Restoration

Related terms: revegetation, ecosystem services, post-mining land use

Definition: The process of returning disturbed land to a functional ecological state after mining activities cease. Example: Re-establishing native grassland on a reclaimed open-pit site. Practical application: Using native seed mixes and monitoring biodiversity recovery. Challenges: Long-term funding and ensuring ecological equivalence.

Hazardous Waste Management

Related terms: classification, disposal, treatment technologies

Definition: Procedures for handling, storing, and disposing of waste that poses a risk to human health or the environment. Example: Stabilising arsenic-rich tailings with cementitious binders. Practical application: Obtaining permits for hazardous waste landfills. Challenges: Strict regulatory compliance and community opposition.

Health, Safety and Environment (HSE) Management

Related terms: risk assessment, incident reporting, compliance

Definition: Integrated approach to protect workers, communities, and ecosystems from mining-related hazards. Example: Implementing a zero-harm safety culture at a coal mine. Practical application: Conducting regular safety drills and environmental inspections. Challenges: Balancing productivity pressures with safety priorities.

Hydrometallurgy

Related terms: leaching, solvent extraction, waste streams

Definition: The use of aqueous chemistry to extract metals from ores, concentrates, or waste materials.

Example: Applying pressure leaching to recover copper from low-grade ore. Practical application: Designing closed-loop circuits to recycle leach solutions. Challenges: Managing effluent quality and scaling up laboratory processes.

Impact Investing

Related terms: social return, ESG metrics, blended finance

Definition: Investment strategies that aim to generate positive social or environmental impact alongside financial returns. Example: Funding a community-owned lithium extraction venture that adheres to strict environmental standards. Practical application: Using impact-measurement frameworks to report outcomes. Challenges: Aligning impact goals with investor risk tolerance.

Indigenous Rights and Free, Prior and Informed Consent (FPIC)

Related terms: land tenure, cultural heritage, partnership

Definition: The principle that indigenous peoples must be consulted and give consent before resource projects affect their lands or cultures. Example: Securing FPIC from a First Nations community before expanding a mine. Practical application: Co-creating benefit-sharing agreements with indigenous partners. Challenges: Complex legal frameworks and ensuring meaningful participation.

Infrastructure Footprint

Related terms: road network, energy supply, logistics

Definition: The total environmental and social impact associated with the construction and operation of supporting facilities for mining. Example: Assessing the carbon cost of a new rail line to a remote ore body. Practical application: Optimising route design to minimise habitat fragmentation. Challenges: High capital expenditure and long construction timelines.

Integrated Resource Planning (IRP)

Related terms: strategic forecasting, demand analysis, scenario modelling

Definition: A holistic approach that aligns mineral supply strategies with broader economic, environmental,

and social objectives. Example: An IRP that incorporates renewable-energy targets for a national mining sector. Practical application: Engaging multiple stakeholders in scenario workshops. Challenges: Reconciling divergent priorities and data integration across sectors.

Lifecycle Assessment (LCA)

Related terms: cradle-to-grave, carbon accounting, environmental hotspots

Definition: A technique to evaluate the environmental impacts of a product or process from raw material extraction through disposal. Example: Conducting an LCA for aluminium cans to identify emissions from smelting. Practical application: Using LCA results to guide material-selection decisions. Challenges: Data intensity and boundary definition.

Local Content Requirements

Related terms: procurement policies, capacity building, domestic industry

Definition: Regulations that mandate a certain proportion of goods, services, or labour to be sourced locally.

Example: A mining concession in Tanzania includes a 30% local-content clause. Practical application:

Developing training programmes to up-skill the local workforce. Challenges: Balancing quality standards with local supplier development.

Long-Term Stewardship

Related terms: post-closure monitoring, legacy management, trust funds

Definition: Ongoing responsibility for environmental and social impacts after a mine has ceased operation.

Example: Funding a trust to maintain water-quality monitoring for 50 years post-closure. Practical

application: Establishing legally binding stewardship agreements. Challenges: Predicting future regulatory changes and securing sufficient financial guarantees.

Mine Closure Planning

Related terms: reclamation, de-watering, post-mining land use

Definition: The process of preparing for the end of a mining operation, including environmental rehabilitation and socio-economic transition. Example: Designing a closure plan that converts a former pit into a recreation lake. Practical application: Conducting cost-benefit analysis of various reclamation options. Challenges: Uncertainty in long-term ecosystem recovery and community expectations.

Mine Tailings Storage Facility (TSF) Design

Related terms: dam safety, seepage control, performance monitoring

Definition: Engineering of structures to safely store tailings, considering stability, environmental protection, and regulatory compliance. Example: Using a filtered-tailings system to reduce water content and improve stability. Practical application: Implementing real-time dam-monitoring instrumentation. Challenges: Extreme weather events and legacy dam failures influencing design standards.

Mine Waste Valorisation

Related terms: by-product recovery, circular economy, secondary minerals

Definition: The process of extracting additional economic value from waste streams generated by mining.

Example: Recovering rare-earth elements from phosphogypsum waste. Practical application: Installing selective leaching circuits to target valuable trace metals. Challenges: Technical complexity and market

demand for secondary products.

Mining Lease Management

Related terms: royalties, permit renewal, compliance tracking

Definition: Administration of legal rights to extract minerals, ensuring adherence to contractual obligations and regulatory conditions. Example: Monitoring royalty payments for a copper lease in Chile. Practical application: Using software platforms to track lease expiries and obligations. Challenges: Navigating changes in tax policy and community expectations.

Mining Social Impact Assessment (SIA)

Related terms: livelihood analysis, stakeholder mapping, mitigation measures

Definition: Evaluation of how mining activities affect local communities, including health, culture, and economic well-being. Example: Conducting an SIA to identify potential displacement of pastoralists. Practical application: Co-designing mitigation plans with affected groups. Challenges: Capturing intangible cultural impacts and ensuring inclusive participation.

Net-Zero Strategy

Related terms: carbon accounting, renewable procurement, offset projects

Definition: A comprehensive plan to eliminate net greenhouse-gas emissions across a mining operation's value chain. Example: A nickel producer commits to a net-zero target by 2040, including scope-3 emissions. Practical application: Investing in renewable-energy farms and carbon-offset projects. Challenges: Scope-3 measurement complexity and securing reliable offset credits.

Operational Excellence

Related terms: lean management, continuous improvement, KPI

Definition: Systematic pursuit of efficiency, safety, and quality improvements in mining processes. Example: Implementing a lean-six sigma programme to reduce ore-handling waste. Practical application: Monitoring key performance indicators for energy use per tonne mined. Challenges: Cultural change and aligning incentives across departments.

Ore Grade Optimization

Related terms: selective mining, processing efficiency, cut-off grade

Definition: Strategies to maximise the amount of high-grade material extracted while minimising waste. Example: Using sensor-based ore sorting to separate high-grade ore before crushing. Practical application: Adjusting mine sequencing based on real-time grade data. Challenges: Equipment costs and variability in ore characteristics.

Ownership Structures

Related terms: joint ventures, equity stakes, corporate governance

Definition: Legal and financial arrangements that define how mining assets are owned, controlled, and profit-shared. Example: A 50-50 joint venture between a state-owned enterprise and an international miner. Practical application: Structuring agreements to align risk-sharing and decision-making. Challenges: Managing divergent objectives and regulatory approvals.

Performance Benchmarking

Related terms: industry standards, KPI, best practices

Definition: Comparing a mining operation's metrics against peers to identify improvement opportunities.

Example: Benchmarking water-use efficiency against global mining averages. Practical application: Setting targets based on top-quartile performers. Challenges: Data comparability and adjusting for regional differences.

Petroleum-Based Energy Transition

Related terms: fossil fuel reduction, alternative fuels, emissions intensity

Definition: Shift from oil and gas as primary energy sources for mining equipment to lower-carbon alternatives. Example: Replacing diesel-powered haul trucks with electric or hydrogen-fuel-cell models.

Practical application: Conducting feasibility studies for on-site renewable generation. Challenges: Infrastructure for charging or refuelling and technology reliability.

Phosphate Mining Sustainability

Related terms: fertiliser demand, eutrophication, land reclamation

Definition: Practices that ensure phosphate extraction meets agricultural needs while protecting ecosystems.

Example: Implementing controlled waste-rock disposal to prevent runoff of phosphates into streams.

Practical application: Developing a nutrient-balance plan for surrounding farms. Challenges: Managing finite phosphate reserves and potential water-quality impacts.

Post-Closure Land-Use Planning

Related terms: recreational development, biodiversity corridors, economic transition

Definition: Designing future uses for former mining sites that provide environmental and socio-economic benefits. Example: Transforming a reclaimed pit into a solar-farm and wildlife reserve. Practical application:

Engaging local authorities early to align with regional development plans. Challenges: Uncertainty in market demand for alternative land uses and long-term maintenance costs.

Pre-Feasibility Study (PFS)

Related terms: resource estimate, preliminary economics, risk appraisal

Definition: An early-stage evaluation that provides sufficient data to decide whether a project should proceed to full feasibility. Example: A PFS for a copper-cobalt project includes a pilot-plant test of solvent extraction. Practical application: Using PFS results to attract strategic investors. Challenges: Balancing depth of analysis with time constraints.

Product Stewardship

Related terms: life-cycle responsibility, end-of-life management, design for environment

Definition: Managing the environmental impacts of a product throughout its lifecycle, from extraction to disposal. Example: Implementing a take-back programme for used batteries containing mined metals.

Practical application: Collaborating with manufacturers to embed recycled content. Challenges: Logistics of collection and ensuring responsible downstream processing.

Production Efficiency

Related terms: throughput, energy intensity, waste reduction

Definition: The ratio of output (e.G., Metal produced) to input resources (energy, water, labour). Example: Improving crushing efficiency to increase ore throughput by 15% without additional power. Practical application: Deploying real-time performance dashboards. Challenges: Integrating new technologies without disrupting existing operations.

Project Finance Structuring

Related terms: non-recourse debt, equity syndication, risk allocation

Definition: Arrangement of capital for mining projects, balancing debt and equity while allocating risks to appropriate parties. Example: Securing a syndicated loan for a gold mine with a debt-service reserve fund.

Practical application: Using off-take agreements to guarantee revenue streams. Challenges: Volatile commodity prices and stringent lender ESG requirements.

Reclamation Bonding

Related terms: financial assurance, closure fund, regulatory compliance

Definition: Financial instruments that ensure sufficient resources are available for mine reclamation after operations end. Example: Posting a reclamation bond equal to 10% of estimated closure costs. Practical application: Regularly updating bond amounts as closure plans evolve. Challenges: Accurate cost estimation and potential bond-release delays.

Renewable Energy Integration

Related terms: solar farms, wind turbines, hybrid power systems

Definition: Incorporating renewable-energy sources into the power supply for mining operations to reduce carbon intensity. Example: A remote iron-ore mine installs a 50 MW solar plant complemented by battery storage. Practical application: Conducting grid-stability studies to ensure reliable supply. Challenges: Intermittency, storage costs, and remote-site logistics.

Resource Governance

Related terms: transparency, anti-corruption, benefit sharing

Definition: Institutional frameworks that oversee the exploration, extraction, and distribution of mineral resources. Example: Implementing the Extractive Industries Transparency Initiative (EITI) standards. Practical application: Publishing annual payments to governments and communities. Challenges: Enforcement in jurisdictions with weak institutions.

Resource Nationalism

Related terms: policy shifts, sovereign control, investment climate

Definition: A government's drive to assert greater control over its natural resources, often through stricter regulations or increased royalties. Example: A country raises mining royalties to capture more value from copper exports. Practical application: Engaging with policymakers to negotiate stable fiscal regimes. Challenges: Investor uncertainty and potential capital flight.

Risk-Adjusted Discount Rate (RADR)

Related terms: cost of capital, ESG premium, project valuation

Definition: The discount rate applied to cash-flow projections that incorporates both financial risk and ESG-related uncertainties. Example: Increasing the discount rate for a project with high water-use risk in a

drought-prone region. Practical application: Using scenario analysis to test sensitivity to RADR changes. Challenges: Quantifying ESG risk premiums and achieving consensus among stakeholders.

Social License to Operate (SLO)

Related terms: community consent, trust building, reputation management

Definition: The informal approval granted by local communities and other stakeholders that enables a mining project to proceed. Example: Maintaining SLO through continuous dialogue with indigenous groups.

Practical application: Developing transparent grievance-redress mechanisms. Challenges: Managing expectations and responding swiftly to concerns.

Stakeholder Mapping

Related terms: interest analysis, influence matrix, engagement plan

Definition: Identifying and categorising individuals or groups affected by or capable of influencing a mining project. Example: Mapping NGOs, regulators, local residents, and investors for a new lithium mine.

Practical application: Prioritising engagement activities based on influence and interest levels. Challenges: Dynamic stakeholder landscapes and conflicting interests.

Strategic Mineral Reserves

Related terms: national security, supply security, stockpiling

Definition: Government-held inventories of minerals deemed essential for economic and defence purposes.

Example: A country maintains a strategic reserve of rare-earth oxides. Practical application: Using reserves to stabilise domestic supply during market disruptions. Challenges: Storage costs, depreciation, and political considerations.

Sustainable Development Goals (SDGs) Alignment

Related terms: UN agenda, impact metrics, reporting frameworks

Definition: Integrating the 17 SDGs into mining strategies to contribute to global sustainability objectives.

Example: Aligning a copper project with SDG 12 (Responsible Consumption and Production) through recycling initiatives. Practical application: Reporting progress against SDG indicators in annual sustainability reports. Challenges: Translating broad goals into specific, measurable actions.

Tailings Re-Processing

Related terms: secondary recovery, waste valorisation, resource efficiency

Definition: Applying new extraction technologies to existing tailings to recover additional metals. Example: Using bio-leaching to extract residual copper from legacy tailings. Practical application: Conducting pilot-scale tests before full-scale re-processing. Challenges: Economic viability and handling of secondary waste streams.

Thermal Energy Recovery

Related terms: waste heat, cogeneration, process integration

Definition: Capturing and re-using heat generated during mineral processing for other plant operations.

Example: Using exhaust-gas heat from a furnace to pre-heat ore slurry. Practical application: Installing heat exchangers to improve overall energy efficiency. Challenges: Integration with existing plant layout and fluctuating heat supply.

Triple Bottom Line (TBL)

Related terms: people, planet, profit, sustainability reporting

Definition: An accounting framework that evaluates an organization's performance based on social, environmental, and financial outcomes. Example: Publishing a TBL report that tracks community employment, emissions, and net earnings. Practical application: Setting balanced KPIs across the three dimensions. Challenges: Weighting each pillar appropriately and avoiding trade-offs.

Underground Mine Ventilation

Related terms: airflow management, energy consumption, worker health

Definition: Systems that provide fresh air to underground workings while removing contaminants and controlling temperature. Example: Implementing variable-speed fans to reduce electricity use in a deep-level gold mine. Practical application: Using computational fluid dynamics to optimise ventilation pathways. Challenges: Maintaining safety standards while cutting energy costs.

Urban Mining

Related terms: e-waste recycling, circular economy, resource recovery

Definition: The process of reclaiming valuable metals from discarded electronic devices and urban waste streams. Example: Recovering cobalt and lithium from spent batteries in a city-wide collection programme. Practical application: Establishing specialised recycling facilities close to consumption centres. Challenges: Complex material composition and fluctuating feedstock quality.

Value-Chain Transparency

Related terms: traceability, supply-chain mapping, blockchain

Definition: Visibility of each step in the mineral supply chain, from extraction to end-use, enabling verification of sustainability claims. Example: Using blockchain to track ethically sourced tin from mine to electronics manufacturer. Practical application: Publishing traceability reports for customers. Challenges: Data integration across multiple actors and protecting proprietary information.

Variable Cost Management

Related terms: operating expenses, cost control, efficiency initiatives

Definition: Strategies to control costs that fluctuate with production volume, such as energy, consumables, and labour. Example: Negotiating power-purchase agreements to stabilise electricity costs for a mine. Practical application: Implementing cost-per-tonne dashboards for real-time monitoring. Challenges: External price volatility and contract rigidity.

Water Balance Modelling

Related terms: hydrological cycle, consumption accounting, sustainability metrics

Definition: Quantitative analysis of water inputs, outputs, and storage within a mining operation to ensure sustainable use. Example: Modelling water demand for ore processing versus available surface water in an arid region. Practical application: Setting water-use reduction targets based on model outputs. Challenges: Climate variability and data gaps in remote catchments.

Waste-Rock Management

Related terms: geochemical testing, acid generation potential, containment

Definition: Handling of non-ore rock removed during mining, focusing on preventing acid generation and environmental contamination. Example: Conducting sulphide content tests to classify waste rock as inert or potentially acid-generating. Practical application: Designing lined storage facilities for acid-generating waste rock. Challenges: Long-term monitoring and ensuring containment integrity.

Yield Optimization

Related terms: process recovery, metallurgical efficiency, product purity

Definition: Maximising the proportion of valuable metal recovered from ore while minimising losses.

Example: Adjusting leach-circuit parameters to increase copper recovery from 85% to 90%. Practical application: Deploying advanced sensors to monitor extraction efficiency in real time. Challenges: Balancing higher recovery with increased reagent consumption and waste generation.

Zero-Discharge Mining

Related terms: closed-loop water, effluent treatment, sustainability ambition

Definition: An operational goal where all water used in mining processes is reclaimed, reused, or evaporated, eliminating liquid waste discharge. Example: A gold mine achieves zero-discharge by treating all process water through reverse-osmosis. Practical application: Integrating evaporative ponds for brine concentration. Challenges: High capital costs for treatment infrastructure and managing concentrate disposal.