



27th World  
Mining Congress  
LIMA PERU  
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INSTITUTO  
DE INGENIEROS  
DE MINAS  
DEL PERÚ

# WORLD MINING CONGRESS 2026

LIMA, PERU | 24–26 JUNE 2026

TECHNICAL PROGRAM — FOREWORD BY THE TECHNICAL PROGRAM CHAIR

## MINING AND THE GLOBAL ENERGY TRANSITION: WHY THIS CONGRESS MATTERS

We stand at an inflection point in human civilisation. The accelerating transition from fossil fuels to clean energy – wind turbines, solar panels, battery storage systems, and electric vehicles – is not primarily a technological challenge. It is, at its foundation, a materials challenge. Every megawatt of renewable energy capacity installed, every electric vehicle that displaces a combustion engine, every grid-scale battery that stores the sun's energy overnight, depends on a foundation of mined materials: copper, lithium, cobalt, nickel, manganese, rare earth elements, graphite, and many others. Mining is the industry that makes that future physically possible.

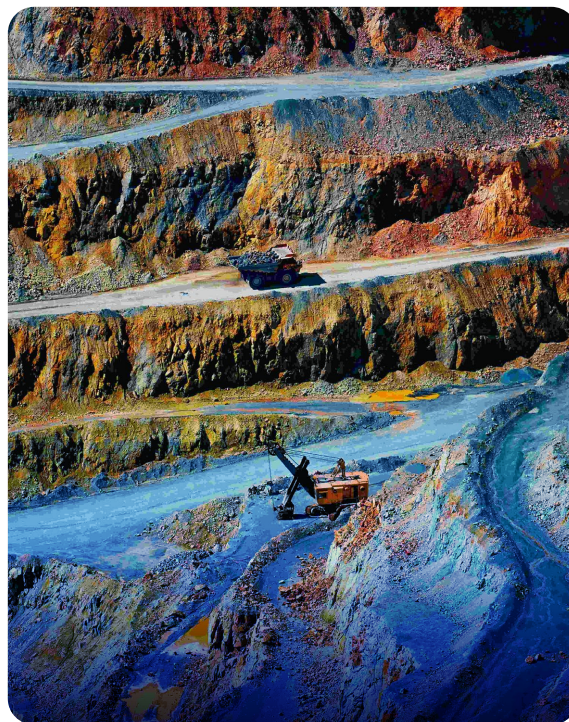
The scale of this requirement is extraordinary. Credible analyses by the International Energy Agency and the World Bank project that achieving net-zero emissions by 2050 will require a four- to sixfold increase in the supply of critical minerals over the next two decades. A single onshore wind turbine requires roughly nine tonnes of copper and hundreds of kilograms of rare earths. A utility-scale battery storage facility requires thousands of tonnes of lithium and nickel. The global electric vehicle fleet, if it reaches the one billion vehicles projected under ambitious climate scenarios, will require cumulative copper demand equivalent to several times the entire copper production of the twentieth century. These numbers are not abstractions; they represent the challenge to which the mining industry must rise.

Yet confronting this challenge requires something more than acknowledging the scale of demand: it demands an recognition of urgency. The world needs these materials now – not in thirty years. We cannot afford the luxury of incremental improvement or business as usual. We cannot afford to be wasteful with time, capital, or resources. This Congress is convened in that spirit of urgency, and that urgency defines its central challenge: how does the mining industry rise to meet a compressed and unforgiving timeline?



The papers and discussions at **WMC 2026** will focus on two interconnected fronts. The first is radically increasing output from existing assets – responsibly, without cutting corners on safety or environmental stewardship, but with a seriousness of purpose that challenges every assumption about what “normal” production looks like. The second is significantly shortening project delivery timelines: compressing the years – and too often, the decades – it takes to bring new capacity into production. Both imperatives demand that we challenge the status quo, question inherited constraints, and resist the institutional inertia that slows the industry’s response to the greatest materials challenge in modern history.

These dual imperatives are given precise and urgent form in the foundational paper of this Congress, **“Mind the Gap,”** by Doris Hiam-Galvez and co-authored by Allan Moss, Peter Harvey, Nestor Deza, Nathan Stubina, Roberto Valle. Using copper as its prime example – the metal most central to electrification and the one whose supply shortfall is most clearly in view – the paper lays out in unambiguous terms the gap between what the energy transition requires and what current trajectories will deliver. It is a paper about delivery: about what it will concretely take, operationally and institutionally, to close that gap within the timeframe that matters. We commend it to every delegate as the lens through which to read this program.



It is perhaps fitting – and not entirely coincidental – that **WMC 2026 opens in the same week as Inti Raymi**, the ancient Andean festival of the sun that has marked the winter solstice and the promise of renewal for centuries. **The themes of this Congress – Mining for the Future, Trust, Transformation, and Technology** – carry something of that same spirit: a deliberate turning toward what is possible, a collective commitment to begin something new. The challenges ahead are real and the timeline is unforgiving. But so too is the industry’s capacity, when it chooses to exercise it, to move with speed and resolve.

It is in this context that the World Mining Congress convenes in Lima, Peru, for its **27th edition in June 2026**. Peru is the world's second-largest producer of copper and zinc, and a leading producer of silver, gold, lead, and molybdenum. Latin America as a whole holds more than half of the world's known lithium reserves and a dominant share of its copper resources. To host this Congress in

the Andean heartland of global mineral supply is to situate the conversation precisely where it must occur: at the nexus of resource endowment, industrial ambition, indigenous rights, environmental stewardship, and geopolitical significance.

The theme of **WMC 2026** – mining's evolving role in a resource-constrained, decarbonizing world – runs as a thread through every session and every track of this program. The questions the industry faces are not merely technical. They are questions of governance, social legitimacy, environmental responsibility, and the fair distribution of the wealth that minerals generate. The presentations gathered here, drawn from more than 70 countries and spanning the full spectrum from deep-sea polymetallic nodule collection to geothermal decarbonization in the Andes, reflect an industry that is simultaneously under the most intense scrutiny it has ever faced and rising to that scrutiny with genuine innovation.

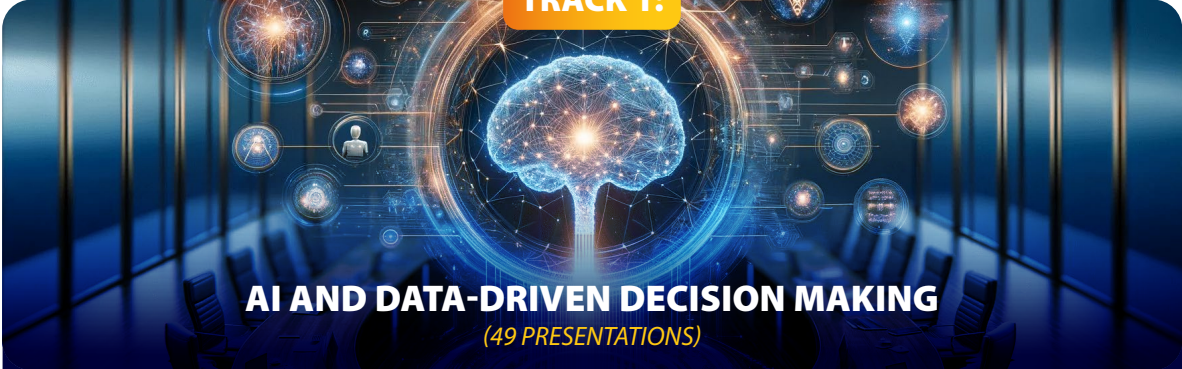


**The Technical Program for WMC 2026 comprises 266 oral presentations organized across nine thematic tracks and more than 40 sessions**, structured over three days of intensive exchange. The program has been designed to ensure that no discipline operates in isolation: a geotechnical engineer will find their work connected to questions of environmental closure; a process metallurgist will encounter the AI systems that are transforming their field; a policy specialist will confront the ground-level social realities that determine whether any policy succeeds. This integration is intentional. The challenges ahead demand it.



## SYNOPSIS OF TECHNICAL TRACKS AND SESSIONS

The following provides an overview of the nine thematic tracks that constitute the 2026 Technical Program, together with a summary of the principal sessions and the scope of presentations within each track.

A futuristic digital environment with a glowing blue brain at the center, surrounded by various data visualizations, icons, and network lines. The background is dark blue with vertical light streaks.

## TRACK 1:

### AI AND DATA-DRIVEN DECISION MAKING

(49 PRESENTATIONS)

The largest track in the program reflects a fundamental transformation underway across the industry. Artificial intelligence, machine learning, digital twins, and data-driven analytics are no longer emerging technologies in mining – they are operational realities, and their scope is expanding rapidly. This track, organized across ten sessions, examines AI applications ranging from mineral exploration and resource estimation to real-time operational optimization, safety management, and processing plant control.

- **AI in Mineral Exploration and Geoscience:**

Sessions examine the use of convolutional neural networks and variational autoencoders for predicting deposit occurrence, hyperspectral data integration for lithological classification, and machine learning workflows for predictive exploration targeting. The promise of AI to compress exploration timelines and reduce discovery costs is examined critically, with presentations separating demonstrable achievement from speculative claims.

- **Automation, Data and AI in Operations:**

Presentations address fleet management systems, autonomous mechatronic systems for mine servicing, and reinforcement learning applications for resource extraction scheduling. A notable contribution explores the connection between classical economic theory and AI-driven extraction optimization.

- **Digital Twins and Connected Operations:**

The application of digital twin architectures to processing plants, SAG mills, and tailings facilities is examined across several sessions, with emphasis on real-time forecasting, uncertainty quantification, and transparent risk-communication frameworks.

- **AI-Enabled Safety and Risk Management:**

Machine learning approaches to slope movement detection, collision avoidance, neural network-based landslide susceptibility mapping, and multi-source monitoring of tailings dam deformation dynamics are presented, reflecting a growing convergence between AI capability and the industry's most critical safety imperatives.

- **Processing and Operational Intelligence:**

Sessions cover AI-assisted grinding circuit control, SAG mill feed characterization through deep clustering, heap leach pad planning using predictive models, and operator-assist systems for copper solvent extraction and electrowinning – demonstrating that AI value creation in processing is now measurable and substantial.

- **Digital Twins and Connected Operations:**

The application of digital twin architectures to processing plants, SAG mills, and tailings facilities is examined across several sessions, with emphasis on real-time forecasting, uncertainty quantification, and transparent risk-communication frameworks.



## TRACK 2:

### PROCESS INNOVATION, CIRCULARITY AND RECOVERY

(45 PRESENTATIONS)

The second-largest track addresses the technical heart of extractive value creation: how ore becomes metal, and how the full chain from comminution to refining can be made more efficient, more sustainable, and more circular. Eight sessions span process optimization, digitalization, copper processing, sustainable water and tailings management, circularity initiatives, bioleaching, and concentrator capital and reliability.

- **Process Innovation, Digitalization and Transformation:**

Presentations examine integrated mine-to-flotation optimization, digital transformation of drilling operations, and the application of dynamic simulation to debottleneck low-grade phosphate concentrators. The session makes a strong case that digitalization delivers measurable throughput and cost improvements when implemented with rigorous operational discipline.

- **Copper Processing Innovation and Extraction:**

Flash flotation in regrind circuits, new developments in heap leaching, in-situ copper recovery, advanced flotation strategies for rare earth ores, and zero-waste copper extraction processes are presented. This session responds directly to the global demand signal for copper that the energy transition is generating.

- **Circularity and Waste-to-Value:**

Multiple presentations address the conversion of tailings, waste rock, and process residues into valuable materials or construction inputs. Topics include uranium removal using natural biosorbents, iron tailings valorization, arsenic removal and stabilization, and the carbon footprint of precious metal recovery from electronic waste – an emerging area that blurs the boundary between primary and secondary mining.

- **Concentrators, Capital, Reliability and Sustainability:**

Large copper concentrator design evolution over three decades, grinding mill failure prevention, life-cycle-based carbon footprint metrics for mineral processing, and dynamic process simulation for capital optimization are examined, with a consistent emphasis on the interplay between capital efficiency and environmental performance.

- **Sustainable Water and Tailings Solutions:**

Filtered tailings implementation, commingling of tailings and waste rock, solar water decontamination for remote areas, and integrated water-energy-tailings optimization (Mine to Tailing 4.0) are presented, reflecting the growing recognition that water management is both a critical risk and a competitive differentiator.

### TRACK 3:



Environmental stewardship represents perhaps the greatest legitimacy challenge facing the mining industry today, and this track addresses it comprehensively across six sessions. The range of topics – from real-time hydrogeological modelling and tailings geotechnics to mine closure governance, decarbonization pathways, and biodiversity – reflects an industry that has moved well beyond compliance toward genuine integration of environmental thinking into operational and strategic decision-making.

- **Digital Water and Environmental Intelligence:**

Advanced hydrogeological modelling, water stress projections for global mineral production, cemented paste backfill optimization, and integrated water resources management are examined. The session reflects the growing recognition that water scarcity is among the most material risks facing mining operations in arid and semi-arid regions.

- **Tailings, Waste, Water and Closure:**

Seepage analysis for filtered tailings in high-precipitation Andean conditions, in-pit tailings storage as a sustainable closure solution, geosynthetic advances in closure covers, and waste rock commingling at Antamina are among the presentations. The Antamina case study, from one of the world's largest copper-zinc mines, located near the congress venue, is of particular relevance to the host country audience.

- **Mine Closure and Post-Mining Reclamation:**

A legal governance framework for post-mining territories, the conversion of the Águas Claras pit into a world-class sports venue in Brazil, and the musealization of mining sites as a vehicle for heritage and economic revitalisation are presented – collectively making the case that mine closure, if planned from the outset, can create lasting positive legacies.

- **Decarbonization, Electrification and Energy:**

CO<sub>2</sub> mineralization in underground mines, the transformation of the VA Erzberg iron ore mine from diesel to full electric operation, green cube reclamation technologies, and geothermal potential for decarbonizing Andean mining operations are among the highlights. These presentations collectively sketch a credible pathway toward deep decarbonization of mining operations.

- **Managing Mine Residues and Nature-Positive Solutions:**

Dust suppression with biopolymeric reagents, satellite-based spatiotemporal monitoring of tailings facilities, acid mine drainage prediction under climate-induced hydrological shifts, and biodiversity as a core variable in the sustainability equation are presented. The nature-positive framing – moving beyond 'do less harm' to 'create net benefit for ecosystems' is a significant conceptual evolution reflected strongly in this track.

## TRACK 4:

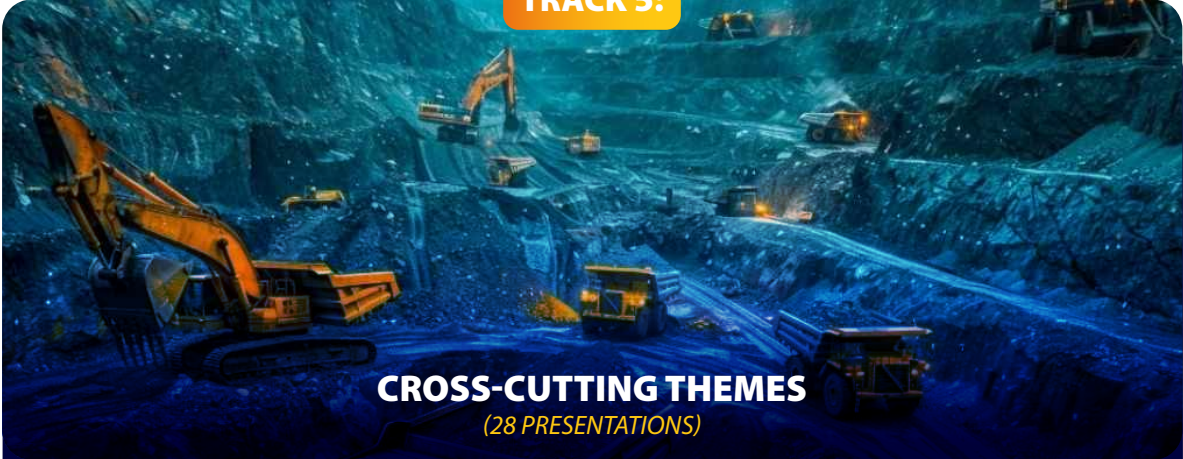


### COAL

(32 PRESENTATIONS)

The Coal track acknowledges that coal remains a significant part of the global energy mix in many emerging economies, while simultaneously engaging seriously with the transition challenges that the sector faces. Presentations span advanced mining technologies, methane management, post-mining repurpose, energy transition frameworks, and the difficult socioeconomic dimensions of coal phase-out.

Chinese contributions are prominent, reflecting that country's technological leadership in mechanized longwall mining, including the world's first fully mechanized 10-metre longwall mining system in extra-thick coal seams, large-diameter shaft drilling, and belt conveyor innovation. Polish and broader European presentations address coal mine methane abatement, ventilation air methane reduction, green hydrogen production from mine methane, and the socially complex process of coal phase-out – including a detailed case study from El Cesar, Colombia, on the conditions for a just socioeconomic transition.



## TRACK 5:

### CROSS-CUTTING THEMES (28 PRESENTATIONS)

The Cross-Cutting track addresses themes that transcend any single technical discipline and are fundamental to the industry's social license to operate. Five sessions cover responsible engineering, mine safety, ESG integration, international disclosure standards, and the systems-level thinking required to navigate the complexity of modern mining.

- **Engineering the Next Era of Responsible Mining:**

Mark Cutifani's feature presentation, 'Mining and Our Role in Society: The Materials Solutions Industry,' sets the strategic frame. Supporting presentations address industry-academia collaboration models, in-place mining technologies, urban mining, and the integration of ESG principles from project inception. The session reflects a generation of mining leaders who have genuinely internalized the proposition that technical excellence and social responsibility are not in tension.

- **From Incidents to Insight — Advancing Mine Safety:**

Presentations examine what incident data reveal about the effectiveness of critical controls, multi-criteria assessment for open-pit to underground transitions, and innovative injection technologies for ground consolidation. The session confronts the persistent challenge of translating safety knowledge into reliable operational behavior at the face.

- **Integrating ESG and Innovation in Mining Systems:**

Life cycle assessment versus direct emission methods for quarrying, horizontal well applications for critical minerals, localizing the UN Sustainable Development Goals for mine project evaluation, and mechanized tunnelling for low-emission operations are presented. This session is notable for its methodological rigor: it asks not just whether mining can be more sustainable, but how sustainability claims can be measured, verified, and compared.

- **Bringing Clarity to Disclosure:**

International reporting standards for sustainability, voluntary standard alignment with strong sustainability principles, and methodological tools for evaluating institutional constraints in mineral supply chains are examined. As investors, regulators, and downstream customers demand greater transparency, these sessions address the frameworks that will govern how the industry accounts for its impacts and contributions.

An aerial view of two miners wearing yellow and white hard hats and high-visibility vests. They are standing on a dark, rocky surface, looking at a tablet held by one of them. The background shows a rugged, rocky landscape.

## TRACK 6:

### **MINING ENGINEERING AND MINE PLANNING**

(27 PRESENTATIONS)

This track addresses the core technical disciplines of underground and surface mine engineering across five sessions, with a particular emphasis on geomechanics, blast engineering, frontier mining environments, and the integration of uncertainty into planning.

- **Transforming Underground Stability and Extraction:**

Geotechnical modelling of vertical stopes in kimberlite under Arctic conditions, graphene-reinforced GFRP ground anchors as sustainable alternatives to steel, innovative ground support techniques, and the three-level sequential recovery of ore pillars from sublevel stopping are among the presentations. The session reflects an underground mining community pushing the boundaries of what can be extracted safely and economically.

- **Blasting, Explosives and Rock break:**

A quantitative flyrock framework for surface mining, the impact of load diameter and spacing on presplit design, extended sleep times for reactive ground, and the integration of digital technologies with advanced explosives for open-pit gold operations are presented. These contributions collectively advance the case that blasting remains a discipline with substantial room for safety improvement and value creation.

- **From Seafloor to Haul Roads:**

The program's most geographically diverse session spans deep-sea critical mineral collection systems, structural integrity management for critical mining infrastructure, haul road improvement through multidirectional rigid geogrids, and blasting-to-crushing cost minimization. The inclusion of deep-sea mining reflects the growing seriousness with which polymetallic nodule resources are being considered as a future supply source for battery metals.

- **Mine Planning Under Uncertainty and Complexity:**

Constraint programming for mine sequencing with geometallurgical variables, stochastic mine planning and design, probabilistic cash cost and NPV assessment using Monte Carlo simulation, and discrete-event simulation for underground decision-making are presented. This session reflects the maturation of planning science: uncertainty is no longer treated as noise to be suppressed, but as a fundamental input to be modelled and managed.

**TRACK 7:**

## **ANDEAN FLAGSHIP SESSIONS**

*(18 PRESENTATIONS)*

The Andean Flagship Sessions are a defining feature of WMC 2026 as a Latin American congress, bringing together regional and global perspectives on the themes that matter most to the host continent. Three sessions address sustainability legacies, Latin America's shifting geopolitical role in mineral supply, and smart mining innovation case studies from Andean operations.

- **From Resources to Influence — Latin America's Mining Shift:**

The structural transformation of Latin American copper concentrate trade networks, Peru's strategy for sustainable investment promotion, the geopolitical implications of the region's critical mineral endowment (the 'Mineral Iceberg'), and the Pillones public-private partnership in Arequipa are presented. These contributions make a compelling case that Latin America is moving from price-taking commodity supplier to active shaper of the global minerals agenda.

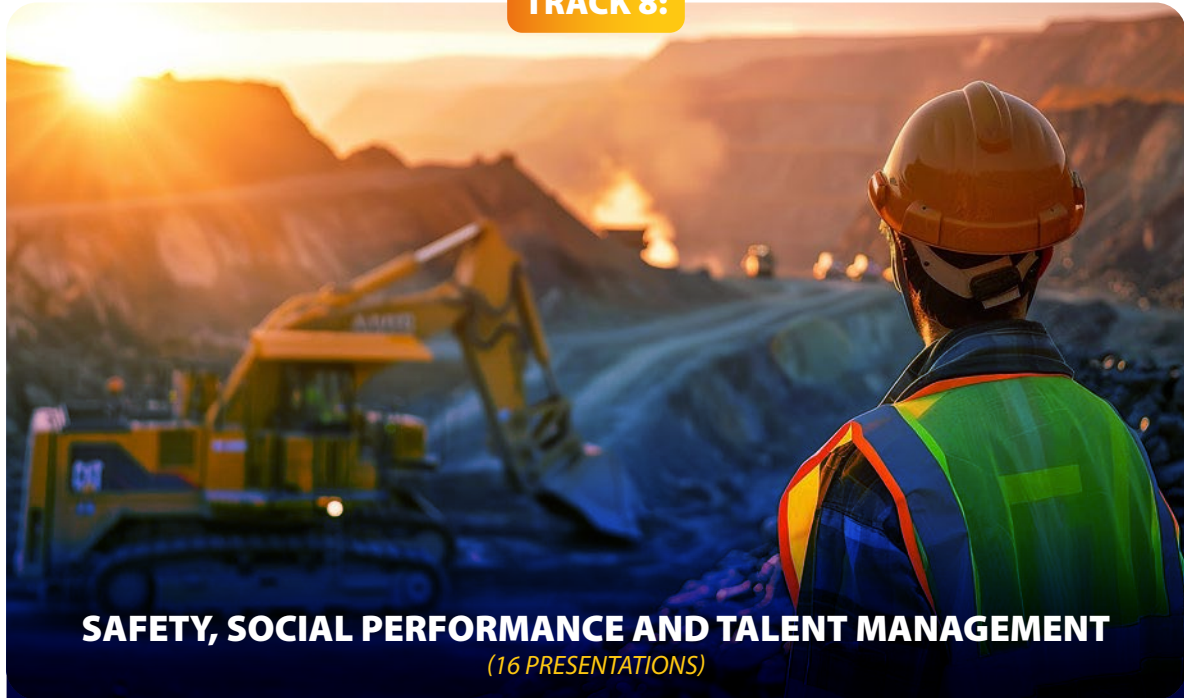
- **From Closure to Legacy — Rethinking Mining Sustainability:**

Post-mining governance in Peru and Colombia, mine closure as a social transition challenge, the progress of biodiversity offset frameworks in Peru against international guidelines, geothermal potential for Andean decarbonization, and the conditions for a community-mining social compact ('Triangle of Trust') are examined. This session confronts the full arc of the mining lifecycle as experienced in Latin American communities.

- **Innovation at Work — Case Studies in Smart Mining:**

Peru's first autonomous ultra-class truck fleet at Quellaveco, AI-powered mineral exploration in Cajamarca, digital transformation at Minera Chinalco Peru, and Buenaventura's long-term value creation model are presented. These case studies demonstrate that world-class smart mining innovation is not the exclusive province of Australia, Canada, or Chile – it is happening in the Peruvian highlands.

## TRACK 8:



### **SAFETY, SOCIAL PERFORMANCE AND TALENT MANAGEMENT** (16 PRESENTATIONS)

This track addresses the human dimensions of mining: the safety of those who work underground and in processing plants, the relationships between mining operations and the communities in which they operate, and the development of the workforce that will carry the industry into the next generation. Three sessions cover safety leadership and critical controls, social performance and indigenous partnerships, and future workforce development.

- **Health and Safety Leadership, Risks and Critical Controls:**

The Quantum Potential Index for measuring potential severity, the rehumanization of safety leadership in smart mining environments, critical control management systems, situational awareness in automated systems, and the who-pays-for-justice question for mining-affected communities are presented. The session reflects a safety culture community that is increasingly integrating human factors science, systems thinking, and AI into its practice.

- **Social Performance and Indigenous Partnerships:**

From consultation to co-ownership, the operationalization of partnership frameworks with indigenous communities, the integration of indigenous values into project development, territorial governance as a tool for rebuilding trust, and responsible mining frameworks for the Indian context are presented. The consistent emphasis on genuine partnership – not merely procedural consultation – reflects a hard-won understanding that social license cannot be engineered from above.

- **Future Workforce and Education Innovation:**

Bridging the double talent gap through AI and education, virtual and augmented reality in mining education, and a sustainable industry-academia collaboration model are presented. As automation and digitalization reshape the skills required of mining professionals, these presentations address the educational systems that will need to evolve alongside the technology.



## TRACK 9:

### **CRITICAL MINERALS, STRATEGIC MATERIALS AND MINERAL POLICY** (16 PRESENTATIONS)

The Critical Minerals track addresses the policy, governance, and supply chain dimensions of the minerals that are central to the energy transition. Three sessions examine institutional pathways for responsible mining, the practical challenges of delivering critical mineral supply, and the broader strategic and geopolitical landscape.

- **Institutional Pathways for Responsible Mining:**

Mining knowledge governance for the green transition, integrated management models for mining cluster viability, governance risks from informal and illegal mining operations, and economic-environmental-cultural transformation frameworks are presented. The session reflects a global policy community grappling with the institutional conditions under which responsible mineral supply can be reliably achieved.

- **Delivering Critical Minerals:**

Ion-exchange resins for lithium hydroxide purification, lithium mineral processing in Brazil, the art of implementation in the critical minerals era, and a 25-year review of copper in Peru are presented. These technically and historically grounded contributions bridge the gap between policy aspiration and production reality.

- **Strategic Materials and Mineral Policy:**

Europe's global playbook for critical raw materials, the Nordic mining cluster in the EU-China-Global South triangle, geochemical exploration for critical raw materials in the Iberian Pyrite Belt, guarantee schemes for financing critical mining projects, and the methodological challenges of voluntary sustainability standards in midstream supply chains are presented. The geopolitical dimension of critical mineral supply – increasingly shaping national industrial policies and international trade negotiations – is given the serious analytical treatment it deserves.



## A PROGRAM DESIGNED FOR THE CHALLENGES AHEAD

The World Mining Congress has, since its founding in 1958, served as the principal forum in which the global mining community examines itself – its achievements, its failures, and its obligations. The 2026 program in Lima is, by any measure, among the most ambitious and wide-ranging in the Congress's history: 266 presentations, nine tracks, contributors from more than 70 countries, and a host nation whose own mining story is inseparable from the global story of the energy transition.

The Technical Program Committee has sought to ensure that this program is both technically rigorous and genuinely useful to practitioners. Sessions have been structured to create dialogue between disciplines that too rarely meet: between exploration geologists and AI researchers, between tailings engineers and biodiversity specialists, between indigenous community representatives and mine closure planners. The Andean Flagship Sessions ensure that the perspectives of the host continent are not merely welcomed but central to the program's intellectual architecture.

