



CHALLENGE TITLE

Energy Operating System for Mining: Integration, Optimization, and Digital Management

CHALLENGE DESCRIPTION

This challenge seeks to develop and validate an integrated energy operating system for mining operations, enabling digital management, optimization, and traceability of energy flows. The system should incorporate real-time data acquisition, predictive analytics, and control strategies to improve energy efficiency and reduce emissions across mining processes.

GENERAL OBJECTIVE

Design and implement a digital energy operating system for mining that enables integrated management, optimization, and traceability of energy use and emissions.

SPECIFIC OBJECTIVES

1. Develop digital platforms for real-time monitoring and control of energy consumption in mining operations.
2. Integrate predictive analytics and optimization algorithms to improve energy efficiency.
3. Enable traceability of energy flows and emissions through interoperable systems.
4. Validate the system in operational environments with performance and sustainability indicators.
5. Generate technical documentation and protocols for industrial adoption.

EXPECTED RESULTS

- Validated digital platform for energy management in mining operations.
- Performance indicators for energy efficiency and emission reduction.
- Demonstration pilots with real-time monitoring and control capabilities.
- Technical documentation and integration protocols.

SCOPE

Includes:

- Digital systems with TRL ≥ 4 applicable to mining energy management.
- Demonstrations in controlled relevant environments and operational pilot testing.
- Evaluation of technical, energy, environmental, and economic performance.
- Integration with existing mining infrastructure and energy systems.



Does not include:

- Proof-of-concept and/or laboratory-scale tests (TRL < 4).
- Solutions that pose risks to worker, equipment, or environmental safety.
- Technologies that increase consumption of strategic resources such as water or energy.
- Interventions that alter or interfere with continuity of the production process.

KEY PERFORMANCE INDICATORS (KPIs)

- Improvement in energy efficiency (% reduction in energy consumption per ton of ore processed).
- Reduction in GHG emissions associated with energy use (kg CO₂e/ton).
- System interoperability and integration success rate (%).
- Economic feasibility of implementation (US\$/ton processed vs. baseline).

DESIRABLE CONTRIBUTION TO ITL CAPACITY BUILDING

- Development of digital infrastructure for energy monitoring and control in mining.
- Creation of training programs for energy management and digital system operation.
- Protocols for validation and certification of energy operating systems.
- Partnerships with academic and industrial stakeholders for system deployment.