

Intelligent Base Station Energy Management System for Mining Use



Overview

CN105159262A The management platform can be improved, optimized and upgraded continuously, and the system combines technology innovation, maintainer's expe.

Key Takeaways

Intelligent Base Station Energy Management Systems (EMS) for mining integrate AI, IoT, and hybrid energy storage to optimize energy use, reduce costs, and ensure reliable power in remote and energy-intensive mining operations.

Overview

Mining operations are highly energy-intensive, and base stations supporting communication and automation require stable, efficient power. An intelligent EMS combines real-time monitoring, predictive analytics, and energy storage to manage energy demand, reduce peak loads, and integrate renewable sources such as solar or wind. These systems are particularly valuable in remote mining sites where grid reliability is limited.

Key Components

Energy Storage Systems (ESS) Lithium-ion batteries or hybrid storage solutions store excess energy during low-demand periods and discharge during peak loads. Modular designs allow quick installation and maintenance, with independent control of battery groups to prevent circulation risks. Integration with photovoltaic (PV) or wind power ensures continuous energy supply and reduces reliance on diesel generators.

AI and Io

T Integration

Sensors and smart meters collect real-time data on energy consumption, equipment performance, and grid quality.

A

I algorithms predict energy demand, optimize load distribution, and enable predictive maintenance, reducing downtime and operational costs.

Io

T connectivity allows remote monitoring and control of multiple base stations across the mining site.

Hybrid Energy Management

Combines renewable energy, grid power, and backup diesel generators to maintain stable and flexible power supply.

Smart EM

S dynamically switches between energy sources based on real-time demand and resource availability, improving efficiency and reducing carbon footprint.

Communication and Monitoring LPWAN technologies like LoRaWAN, NB-IoT, and decentralized mesh networks (Wirepas) enable long-range, low-power communication for sensors in complex mining environments. Real-time monitoring supports operational safety, preventive maintenance, and energy efficiency, potentially reducing energy consumption by up to 20%.

Benefits for Mining Operations

Cost Reduction: Optimized energy use and peak load management lower electricity and fuel costs. Operational Reliability: Continuous power supply ensures uninterrupted communication and automation systems. Sustainability: Integration of renewable energy and intelligent controls reduces carbon emissions and environmental impact.

Data-

Driven Decision Making: AI and IoT provide actionable insights for maintenance, energy planning, and process optimization.

Implementation Considerations

Conduct energy audits to identify high-consumption equipment and optimize load distribution. Ensure compatibility with existing batteries and power systems for modular expansion. Train personnel in energy management practices to maximize system efficiency and sustainability.

Consider predictive maintenance algorithms to anticipate equipment failures and reduce downtime.

Intelligent EM

S for mining base stations represents a convergence of digital transformation, renewable energy integration, and AI-driven optimization, enabling mining companies to achieve cost-effective, reliable, and sustainable energy management.

Article Content

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The management platform can be improved, optimized and upgraded continuously, and the system combines technology innovation, maintainer's experience and wisdom perfectly.

Smart Energy Management System: Methodology for Open-Pit Mine

This paper proposes, describes, implements, and tests the Energy Monitoring System (EMS), a concept in data acquisition and transmission systems (DATS) applied to real-time cloud

(PDF) Smart Energy Management System: Methodology for Open-Pit

The main goal of this infrastructure is adding an artificial intelligence layer to energy use in an experimental open-pit mine and giving insights on energy consumption and electrical grid...

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The Future of Energy Management in Mining: Smart ...

The integration of smart technologies and innovative practices is transforming how mining operations manage energy consumption, reduce costs, and minimize environmental impact.

Smart Energy Management System: Design of a Monitoring and Peak

The main goal of this infrastructure is adding an artificial intelligence layer to energy use in an experimental open-pit mine and giving insights on energy consumption and electrical grid quality.

Base Station Energy Storage

This solution uses advanced intelligent controls to dynamically manage and switch between energy sources based on real-time site demands and resource availability. As a result, it delivers greater

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Fig. 2 summarizes the evolution of the intelligent level of the coal mine energy system across four dimensions: energy production, energy consumption, supply-demand balancing, and

Optimization Control Strategy for Base Stations Based on

Abstract: With the maturity and large-scale deployment of 5G technology, the proportion of energy consumption of base stations in the smart grid is increasing, and there is an urgent need to reduce

Energy Storage for Communication Base

The one-stop energy storage system for communication base stations is specially designed for base station energy storage. Users can use the energy storage system to discharge during load peak

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Artificial intelligence

Artificial intelligence(AI) is the capability of computational systemsto perform tasks typically associated with human intelligence, such as learning, reasoning,

Assessing technological trends in mining fleet energy management

This systematic review evaluates energy management strategies for mining haul trucks, focusing on their role in achieving sustainable mining operations. This review highlights integrating

Smart Energy Management System: Design of a

In order to minimize the energy consumption, which impact directly the profit and the efficiency of the industry, a design of a monitoring and peak

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However, the complexities of CM structure and operations, the shortage of automation and intelligent control techniques, and the stringent operation criteria, lead to high energy consumption,

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Smart Energy Management System: Methodology for Open-Pit Mine Power Grid Monitoring Applications June 2023 DOI: 10.1007/978-981-99-3424-9_5 In book: Human Centred

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