

Quality of High-Voltage Power Distribution Cabinets in Sierra Leone



Overview

Abstract: Based on the analysis of the main types and characteristics of high and low voltage distribution cabinets in distribution rooms, this paper discusses the basic principles for selecting these cabinets.

Key Takeaways

High-voltage power distribution cabinets in Sierra Leone face significant challenges due to aging infrastructure, voltage instability, and limited maintenance, impacting overall power quality and reliability.

Current State of High-Voltage Distribution

Sierra Leone's electricity distribution network is still recovering from historical disruptions, including the civil war (1991–2002) and the Ebola outbreak in 2014, which severely damaged infrastructure and limited access to reliable electricity. The national grid covers less than 13% of the population, with most electricity concentrated in Freetown, Kenema, Bo, and Makeni. High-voltage distribution cabinets, which are critical for stepping down and routing electricity safely, are part of this constrained network and are often exposed to extreme voltage variations, load discharges, and frequent outages.



Technical Challenges

The quality of high-voltage cabinets is affected by several factors: Voltage Fluctuations: Power supply variations of over $\pm 30\%$ are common, stressing distribution equipment and reducing cabinet lifespan. Aging Infrastructure: Many cabinets and associated switchgear are outdated, with limited capacity to handle modern load demands or integrate renewable energy sources. Environmental Conditions: High humidity (84–93%) and heavy rainfall during the rainy season (May–October) accelerate corrosion and deterioration of cabinet components.

Limited Maintenance: Sparse technical personnel and insufficient monitoring systems reduce the effectiveness of preventive maintenance, increasing the risk of equipment failure.

Regulatory and Quality Standards

The Sierra Leone Grid Code outlines operational and maintenance standards for high-voltage transmission and distribution equipment, including cabinets. It defines responsibilities for the Transmission Network Operator and System Operator, emphasizing safe operation, connection protocols, and integration of renewable energy. However, practical implementation is limited by resource constraints and the current capacity of utilities like the Electricity Distribution and Supply Authority (EDSA),.

Mitigation Measures

To improve cabinet performance and power quality: Voltage Stabilizers: Devices such as those from Watford Control are used to regulate voltage, protecting sensitive equipment and reducing stress on high-voltage cabinets. Network Upgrades: Investment plans, including a \$3.5 billion transmission and distribution improvement initiative, aim to modernize cabinets, switchgear, and lines to enhance reliability.

Preventive Maintenance Programs: Strengthening technical capacity and implementing systematic inspections can extend cabinet lifespan and reduce outages. Conclusion High-voltage power distribution cabinets in Sierra Leone currently operate under challenging conditions, with poor voltage stability, aging equipment, and limited maintenance affecting their quality and reliability. While regulatory frameworks and investment plans provide a roadmap for improvement, practical performance remains constrained by infrastructure limitations and environmental factors.

Adoption of voltage stabilization technologies and systematic upgrades are essential to enhance cabinet quality and overall power distribution reliability.

Article Content

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Grid Code for Sierra Leone Electricity Market

Establishes Rules, Responsibilities and Relationships for Safe and Efficient Operation govern connection, operation, maintenance and development of the high voltage transmission network in

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SUPPLEMENTAL VOLUME

Degradation of power supply reliability and quality, Excess of rated capacity of facilities such as short circuit current, line capacity, transformer capacity, etc. and Increase of maintenance cost due to

Sierra Leone Electricity Transmission Network

Data for medium and high voltage transmission lines in Sierra Leone. The data were compiled for the AICD study led by the World Bank. A variety of sources were consulted, including regional power...

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Powering Tomorrow: Medium and High Voltage Electrical Distribution Cabinets

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Data-driven healthcare electrification: Measuring power quality for better health outcomes in Sierra Leone Blog 22 Apr 2024 Energy Widespread electrification efforts in sub-Saharan

Increasing Energy Access in Sierra Leone

A key difference between the two countries is that Sierra Leone does not have an agency such as the Nigerian Rural Electrification Agency (REA) dedicated exclusively to rural electrification and energy

(PDF) Long-Term Forecast of Sierra Leone's Energy ...

Using the Long-range Energy Alternatives Planning System (LEAP), this work assesses Sierra Leone's energy supply and demand for 2019–2040.

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Olufolahan Osunmuyiwa and Alexandra Wall Electricity is fundamental to economic growth. In low-income countries (LICs), poor power quality and reliability (PQR), manifesting as outages and

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