

Finnish Distribution Box Model Classification



Overview

All of the aspects of the fault diagnostics are important, but in this thesis the focus is on categorisation of faults.

Key Takeaways

Finnish distribution boxes (DSOs) are classified using both traditional three-category models—urban, rural, and mixed—and advanced seven-category models based on geographic spatial data and k-means clustering.

Historically, Finnish distribution system operators (DSOs) have been categorized into three main types based on their operating environment (OE):

- Urban: High building density, many connection points per customer, and extensive cabling.
- Rural: Low building density, fewer connection points, and longer distribution lines.
- Mixed: Intermediate characteristics combining urban and rural features. This classification is primarily used for peer benchmarking and regulatory purposes, with the Finnish Energy Authority (FEA) adjusting network component unit prices based on the OE submitted by DSOs.

Advanced Classification Using Geographic Data

Recent studies have introduced a more nuanced classification using geographic spatial data and k-means clustering. This methodology:

- Collects spatial and network data from DSOs.
- Applies k-means clustering to group DSOs into seven categories, providing finer distinctions than the traditional three-class system.
- Accounts for internal variations within DSOs' operating environments, enabling more targeted regulatory and operational analysis . The seven-category model allows regulators and researchers to better understand differences in network density, infrastructure, and operational strategies, bridging datasets from multiple sources for more precise analysis.

Regulatory and Operational Implications

- The FEA uses a rate-of-return regulation model to ensure DSOs earn a reasonable return, independent of their classification.
- Network asset values are calculated using unit prices adjusted for age and type of network components, with considerations for underground cables and substations .
- Classification informs investment strategies, helping DSOs maintain high-quality service while managing cash flow risks, especially in areas affected by demographic shifts from rural to urban regions .

Summary

Finnish distribution box classification combines traditional OE-based categories with modern data-driven clustering approaches. The traditional urban, rural, and mixed categories provide a baseline for regulation and benchmarking, while the seven-category k-means clustering model offers a more detailed, spatially informed understanding of DSOs' operating environments, supporting both regulatory decisions and strategic network planning .

Article Content

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