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KEPCO's Asset Management System(K-AMS) for T&D utilities: Development, Deployment and Roadmap

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Abstract

Korea Electric Power Corporation (KEPCO) manages one of the world's most extensive transmission and distribution (T&D) networks, comprising over 42,000 transmission towers, 924 substations, and approximately 550,000 c-km of distribution lines. As a significant proportion of these assets were installed during Korea's rapid industrialization in the 1970s–1990s, a growing number of aging facilities now require systematic replacement planning. To address this challenge, KEPCO has developed K-AMS (KEPCO Asset Management System), a big data-driven platform that provides risk-based replacement priorities and supports data-driven investment decisions across the entire asset lifecycle. K-AMS currently covers 10 types of T&D assets—including power transformers, gas-insulated switchgear, overhead lines, underground cables, and pole-mounted transformers—totaling approximately 2.6 million units and 80,000 c-km. The system evaluates each asset through a risk matrix that combines the Probability of Failure (PoF) and Consequence of Failure (CoF). PoF is computed by integrating three components: statistical remaining life based on Weibull analysis, condition-based remaining life derived from diagnostic and inspection records, and operational remaining life using degradation models such as the Arrhenius equation. CoF quantifies failure impacts in monetary terms across financial, reliability, safety, and environmental dimensions. Built on over 100 billion records collected from 13 legacy systems, K-AMS incorporates a comprehensive data architecture featuring unique device identifiers, standardized data schemas, 170 data cleansing rules, and load estimation algorithms for unmonitored assets. Following system completion in 2023 with a total investment of KRW 11.4 billion, pilot operations expanded from 4 to 8 regional offices during 2024–2025. Dismantling analysis of decommissioned equipment has confirmed that K-AMS achieves higher accuracy in identifying at-risk assets than the conventional Health Index method.

Looking ahead, KEPCO plans to deploy K-AMS across all 15 regional offices in 2026 and progressively expand asset coverage through a phased roadmap that adds 12 additional asset types by 2030 and beyond. Furthermore, KEPCO aims to extend its asset management technology to emerging infrastructure domains such as energy storage systems (ESS), renewable energy generation facilities, and data centers, thereby broadening the applicability of K-AMS beyond conventional T&D assets. In parallel, the system will advance toward AI-enhanced predictive capabilities, including automated anomaly detection and proactive replacement recommendations. This paper presents the system architecture, algorithm design, data quality strategies, pilot validation results, and the strategic roadmap for establishing K-AMS as a global benchmark in utility asset management.