Transmission Asset Management Analytics (P34)

This program focuses on developing asset knowledge enablers, such as failure rates and tools to help utilities make better lifecycle decisions. There are four projects in this program, each with multiple research tasks and technology transfer activities.

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PROJECT	2025 Accomplishments & Key Deliverables	2026 Plan
P34.001 Asset Management Principles and Practices	• Developed a methodology for evaluating large language models and leveraged the results to select the most suitable model for creating the Transmission Asset Chatbot, designed to provide quick answers to technical questions using EPRI reference books and field guides. **3002034347** - Benchmarking Large Language Models for the Electric Power Sector	• Conduct the Applied Asset Management Analytics Workshop for member utilities to foster collaboration, share emerging analytics applications, and facilitate adoption of EPRI research for improved asset management. • Continue evaluating emerging AI, data science, and statistical techniques and technologies for transmission asset management applications.
P34.002 Substation Asset Analytics	• Trained and tested AI models against EPRI's rule-based Power Transformer Expert System (PTX) software; identified a hybrid approach that improved failure prediction, enhanced high-risk detection, and reduced false alarms. Validated hybrid approach on a large U.S. utility fleet, outperforming both AI-only and rule-based PTX. **3002032722 -** Power Transformer Expert System Software version 12.0 • Expanded the circuit breaker industry-wide database and developed performance metrics and maintenance insights adopted by multiple utilities to optimize maintenance tasks, adjust frequencies, and guide asset replacement decisions. • Implemented a standardized taxonomy and advanced Natural Language Processing (NLP) model for rapid, accurate categorization of circuit breaker maintenance records, enabling efficient historical performance analysis. **3002032718 -** Guidelines for Computer Assisted Circuit Breaker Maintenance Work Order Categorization	• Deliver PTX-AI Hybrid v1.0 software. • Expand taxonomy and NLP-aided categorization methodology to additional transmission assets. • Deliver maintenance work order categorization v1.0 software. • Collect industry-wide data and develop new performance metrics and analytics for transformers, breakers, batteries, protective relays, switches, and other transmission assets.

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P34.003 Overhead Transmission Asset Analytics	• Developed Transmission Line Risk Ranking (TLRR) v1.0 software, using algorithms to rank transmission line circuits by risk based on utility data, enabling utilities to prioritize maintenance, adjust task frequencies, and guide asset replacement decisions. **3002032733 -** Overhead Transmission Line Risk Ranking Software • Analyzed asset behavior by geographical location to uncover unexplored patterns, trends, and connections; published a whitepaper documenting the approach and results. **3002032734 -** Applying Geospatial Data for Overhead Transmission Asset Management	• Refine and enhance Transmission Line Risk Ranking (TLRR) algorithms to incorporate new metrics and lessons from utility implementations; deliver overhead transmission line risk ranking software v2.0. • Continue exploring how location information and remote sensing can enhance analytics for understanding overhead transmission component and system performance. • Develop new metrics from industry-wide data to better estimate the useful life of overhead transmission assets, including structures, conductors, and insulators.
P34.004 Underground Transmission Asset Analytics	• Implemented taxonomy and an algorithm to automatically classify descriptive maintenance records for Self-Contained Fluid-Filled Cable Systems into meaningful categories, such as oil leaks and joint defects. • Implemented algorithms to link SCADA alarm data with underground transmission asset records, enabling utilities to visualize and address critical cable performance issues for improved asset management. **3002032684** – Leveraging Maintenance and Alarm Data for Underground Transmission Asset Management	• Continue developing new metrics from industry-wide data to better assess underground transmission component performance. • Advance analytics for defect classification and information retrieval. • Enhance algorithms to integrate additional data sources with SCADA alarms, expanding analytics for underground transmission asset performance and risk assessment.

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