Tata Consultancy Services (TCS)

AI-Powered Drawing Review Automation for Substations

Industry: Energy & Utilities | Solution Brief

Background & Challenge

TenneT UK operates a complex high-voltage transmission infrastructure where each substation comprises multiple operational bays. Each bay is associated with a comprehensive design package, averaging 240 pages per bay. With 12 bays per substation, the total documentation per site exceeds 2,800 pages.

Currently, engineering teams manually review these PDFs to ensure design accuracy and regulatory compliance. This process is time-consuming, prone to oversight, and inconsistent across contractors. With the energy transition and grid expansion, scalable digital QA is essential.

Use Case 1: AI-Based Drawing Error Detection

TCS proposes an AI-powered module that automatically inspects substation drawings using computer vision and machine learning trained on historical error patterns from past reviews. It identifies:

- Missing or mislabelled components
- Inconsistent symbology
- Layout alignment issues
- Non-compliance with TenneT design standards

This acts as a virtual QA engineer, accelerating verification and enhancing standardisation.

Use Case 2: Repeated Error Identification and Contractor Notification

When the same error type is identified across multiple locations or pages, the AI system:

- Groups those occurrences
- Summarises them into a single actionable insight
- Generates automated notifications to EPC vendors or design-build partners

This improves communication clarity and ensures that systemic issues are addressed at scale.

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Solution Architecture & Technology Stack

TCS will implement this solution using the following technologies:

- Optical Character Recognition (OCR) for PDF text and symbols
- Computer Vision to detect layout and visual inconsistencies
- Supervised ML models trained on engineer-validated errors
- NLP to auto-generate error summaries and contractor messages
- Python (TensorFlow/PyTorch), OpenCV, Streamlit for dashboard integration
- Deployed securely on Microsoft Azure or AWS with scalable compute

Customer Involvement

TenneT's engineering and QA teams will:

- Provide sample drawings and annotated error data
- Validate early AI outputs and guide iterative training
- Review and approve generated issue logs and reports
- Use dashboards for transparency and vendor coordination

Business Benefits

- ~90% reduction in manual drawing QA effort
- Faster detection and resolution of design inconsistencies
- Enhanced vendor accountability through grouped issue reporting
- Standardised drawing validation across substations
- Aligned with TenneT UK's digital twin and grid automation roadmap