⚡ TCS ELCAD QA Assistant for TenneT

Automated Rule-Based & AI-Augmented Drawing Quality Assurance

# 1️⃣ Use Case-Based Approach

The ELCAD QA Assistant supports TenneT's engineering and quality teams by automating the verification of electrical CAD drawings against organizational standards.

* Use Cases Addressed:
* Symbol & Label Validation – Ensure correct symbol-label matching per TenneT's ELCAD standards.
* Compliance Checks – Detect missing DIN/IEC references, legends, zones, title/revision blocks.
* Safety Assurance – Flag missing grounding, breakers, and protective elements.
* Wiring QA – Identify disconnected wires and floating endpoints.
* Layout Checks – Detect overlaps, misplacements, and alignment issues.
* Symbol Misuse Detection – Flag incorrect symbol-label associations.
* False Positive Review – Allow QA engineers to approve findings and export validated results.
* TCS Proposition:
* A configurable GenAI + CV-based QA engine that adapts to any ELCAD rulebook.
* Modular design, scalable across projects, regions, and contractors.
* TenneT Rule Book Integration:
* TenneT’s ELCAD Rule Book will be uploaded once. The app will parse it using GenAI to auto-configure QA logic.

# 2️⃣ Success Criteria

* ≥90% detection accuracy compared to human QA reviewers.
* ≤10% false positives.
* Rulebook-based automated QA rule enforcement.
* 70% reduction in drawing QA time.
* PDF-based report output, suitable for sharing with contractors.

# 3️⃣ Document Error Discovery

* Missing metadata: title, revision, page number.
* Missing safety components: grounding, fuse, breaker.
* Non-compliant drawings: lack of DIN/IEC tags, legends, or zone grids.
* Symbol errors: unknown symbols, misuse, overlapping.
* Label errors: missing labels, misaligned labels, unmatched labels.
* Wiring errors: unconnected lines, floating endpoints.

# 4️⃣ How AI/ML Is Used in Document QA

* CLIP-based image embedding for symbol classification.
* FAISS vector search for template symbol matching.
* EasyOCR for text/label extraction.
* GPT-4 for ELCAD rulebook interpretation.
* ML-based validation of symbol-label consistency.
* NLP-powered report generation.
* Learning loop based on reviewer feedback.

# 5️⃣ Expectations from TenneT

* Official ELCAD Rule Book (PDF/Word) for auto-ingestion.
* 10–20 annotated drawings for calibration and benchmarking.
* Internal QA reviewer involvement for validation and tuning.
* Decision on report format: PDF, Excel, or API integration.
* Optional access to internal symbol library for advanced training.

# 6️⃣ Business Benefits

* 70% faster drawing QA process.
* Lower human error rates through automation.
* High compliance and safety assurance.
* Improved contractor accountability via QA reports.
* Audit-ready documentation for regulatory reviews.
* Scalability across projects and drawing types.