SOURCE REVIEW / ENERGY INFRASTRUCTURE THERMOGRAPHY

UAV thermography for critical energy infrastructure

Implementation-oriented RGB–IR workflow for repeatable inspection of power networks and photovoltaic assets.

DOCUMENT	DATE	PREPARED BY	STATUS
TP-005	OCT 2026	SPECTRA GROUP S.A.S.	TECHNICAL SUMMARY

Technical scope

Ščerba et al. present an implementation-oriented UAV inspection process for transmission, distribution and photovoltaic assets that combines RGB imaging, radiometric IR and optional LiDAR. The work shifts emphasis from isolated defect detection to repeatable field execution: mission planning, radiometric integrity, observation geometry, QA/QC, anomaly quantification and maintenance-ready reporting. The workflow is intended to support predictive maintenance while reducing personnel exposure and, where technically feasible, avoiding outages.

01 Field workflow

Platform. DJI Matrice 4T with 48 Mpx RGB/telephoto imaging and 640 × 512 radiometric IR (8–14 µm; ±2 °C or ±2%).

Two-stage survey. Preliminary flights used controlled conditions; operational flights extended to real environments under UAV weather and flight constraints.

Mission set. 7 missions / 19 flights; 2740 radiometric IR frames, 5.2% rejected in QA/QC; 1304 assets measured (84 HV/MV/LV and 1220 PV).

Findings. 11 anomalies were identified: six on power infrastructure and five on PV assets.

02 QA/QC & analysis

Radiometry. R-JPEG/R-TIFF, preflight and periodic NUC, asset-specific emissivity and multi-angle geometry control drift and reflection effects.

Quality control. BRISQUE/NIQE assess IR frames; SSIM is used on registered RGB/IR crops when pairs are available. Artifacts are tagged and critical elements repeated.

Thermal metric. DJI Thermal Analysis Tool 3 supports polygon averages and profiles; anomalies are quantified as $\Delta T = T_{max} - Tbg$ using a robust local background.

Standardization. PV inspection aligns with IEC TS 62446-3; electrical anomaly documentation follows NFPA 70B:2023. Mission logs, QA/QC records and anomaly lists support trending and escalation.

SOURCE Ščerba, M.; Kišš, M.; Wieszala, R.; Mendala, J.; Tomaszewski, A. Applied Sciences 2026, 16(6), 3014. Published 20 Mar 2026.
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