

## **Drone-enabled NDT and Ai for renewable energy systems and critical infrastructure**

### **ORGANIZED BY**

**Hamza Nasri**, Polytechnic University of Bari

**Jamel Riahi**, Polytechnic University of Bari

**Silvano Vergura**, Polytechnic University of Bari

Renewable energy systems are scaling fast: wind plants, photovoltaic plants, and hydropower facilities are expanding into remote, harsh, and safety-critical environments. At the same time, owners and operators are under pressure to reduce downtime, manage ageing components, and document structural integrity with methods that are traceable and repeatable. This special session focuses on the practical convergence of drones (aerial, ground, and marine), Non-Destructive Testing (NDT and NDE), and AI-based analytics for energy systems, industrial applications, and critical infrastructures. The session builds on consolidated approaches in drone-supported inspection for industrial contexts, drone/NDT workflows for civil infrastructures, and advanced diagnostics for power plants and generation assets. We invite contributions that address what it takes to deploy reliable inspection in the field: sensor selection, mission planning, data fusion, uncertainty, and decision-making. Recent studies show rapid progress in UAV-based wind turbine blade inspection, including thermographic strategies and increasing autonomy, with clear implications for cost and safety. In photovoltaics, outdoor infrared thermography is supported by structured procedures and reporting requirements, enabling more consistent maintenance decisions across sites. In hydropower and dam safety, UAV photogrammetry and AI-enabled damage detection are emerging as impactful tools for inspection and emergency monitoring

Topics of interest include (but are not limited to):

- **Multi-platform inspection (UAV/UGV/USV/UUV) for energy systems, industrial plants, and civil structures (dams, bridges, towers).**
- **Drone-enabled NDT/NDE sensing: IR thermography, LiDAR/photogrammetry, multispectral/hyperspectral, ultrasonic/EM payloads, acoustic/sonar for marine assets.**
- **AI/ML for defect detection, data fusion, uncertainty quantification, and explainable decision support (from reactive to predictive maintenance).**
- **Digital twins for wind/PV/hydropower assets: automated model updating, degradation tracking, and risk-based maintenance planning.**
- **Autonomy, mission planning, and inspection repeatability; benchmarking datasets and performance metrics.**

