

## **Towards the next generation of smart grids-based multi-energy systems raising ICT cutting-edge solutions (Intelligrid)**

### **ORGANIZED BY**

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Cutting-edge ICT technologies are increasingly shaping the transition toward sustainable, resilient, and intelligent energy systems. The integration of Smart Grids with advanced Artificial Intelligence, Machine Learning, and data-driven methodologies enables a new generation of energy management solutions capable of addressing the growing complexity of modern energy infrastructures. These technologies support demand and production forecasting, load balancing, anomaly detection, and adaptive control strategies, while simulation-based approaches contribute to optimizing energy management policies under dynamic and uncertain conditions. The widespread deployment of IoT devices enables real-time monitoring of heterogeneous energy vectors and infrastructures, generating large-scale, high-resolution data streams exploitable through advanced analytics. In this context, Digital Twin paradigms are emerging as powerful tools to virtually represent, simulate, and optimize physical energy systems, enabling scenario analysis, predictive maintenance, and informed decision-making. At the same time, the increasing reliance on automated, data-driven energy management raises ethical and societal challenges related to transparency, accountability, fairness, data governance, and user trust. The convergence of smart grids with electric mobility, distributed renewable energy sources, and local energy communities further amplifies the need for integrated, cross-domain ICT solutions capable of coordinating multi-energy flows holistically. In such socio-technical systems, ethical-by-design approaches and principles from social philosophy are essential to ensure inclusive participation, equitable access to energy resources, and socially acceptable decision-support mechanisms, particularly when AI-driven tools influence collective and individual energy behaviors.

Within this evolving landscape, the proposed special session aims to provide a focused forum for researchers and practitioners working on ICT-driven approaches for Smart Grid-based Multi-Energy Systems and Energy Communities. Contributions are welcomed from a broad range of ICT domains, including Artificial Intelligence, Big Data analytics, Internet of Things, Digital Twins, simulation and agent-based modeling, as well as from interdisciplinary perspectives addressing ethical, social, and governance aspects of intelligent energy systems. The session seeks to foster cross-disciplinary exchange and promote advances in the design, monitoring, simulation, and optimization of smart, multi-vector energy ecosystems that are not only efficient and resilient, but also transparent, trustworthy, and socially sustainable.

