

Special Issue

Digital Twin-Driven Energy Systems Optimization: From Algorithm Innovation to Low-Carbon Operation

Message from the Guest Editors

AI/IoT-enabled digital twins are pivotal for carbon-neutral energy systems, enabling predictive analytics and low-carbon transitions. However, challenges in fidelity, scalability, and interoperability remain. This Special Issue seeks pioneering research addressing these barriers, focusing on carbon reduction, efficiency, and equity impacts. Topics of interest (not exhaustive):

- Physics-Informed Digital Twins: Renewable grid forecasting/stability
- Multi-Scale Architectures: Device → city-scale energy hubs
- AI Surrogate Models: Graph neural networks for thermal-electrical simulation
- Federated Learning: Privacy-preserving decentralized training
- Predictive Maintenance: Anomaly detection for wind/solar downtime reduction
- Co-Simulation Platforms: Multi-energy integration
- Blockchain Digital Twins: Transparent peer-to-peer energy trading
- Carbon-Aware Operations: Life-cycle emission tracking in dispatch
- Human-in-the-Loop Twins: Grid operator support (extreme events)
- Standardization: Interoperable energy digital twins

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I encourage you to contribute a research or comprehensive review article for consideration for publication in Sustainability, an international open access journal which provides an advanced forum for research findings in areas related to sustainability and sustainable development. The journal publishes original research articles, reviews, conference proceedings (peer reviewed full articles) and communications. I am confident you will find the journal contributes to enhancing understanding of sustainability and fostering initiatives and applications of sustainability-based measures and activities.

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