Energy Digital Twin Technologies Training Course

Professional Development Training Course Outline

Category	Renewable Energy	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Energy Digital Twin Technologies Training Course provides a practical and future-focused understanding of how Digital Twin technology, Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), cloud computing, edge analytics, real-time data, predictive analytics, and advanced simulation are transforming modern energy systems. Participants learn how virtual replicas of physical assets, facilities, renewable-energy plants, storage systems, and electrical grids can continuously synchronize with operational data to improve asset performance, energy efficiency, reliability, predictive maintenance, operational intelligence, and decision-making. The course addresses the rapidly evolving digital-energy landscape, including smart grids, renewable energy integration, battery energy storage systems, wind and solar farms, power generation, transmission and distribution networks, microgrids, and intelligent energy management. Current industry and research trends increasingly connect digital twins with AI-enabled forecasting, predictive maintenance, optimization, and real-time grid operations.

Designed for professionals seeking to lead energy digital transformation, the program moves from fundamental digital-twin concepts to advanced implementation strategies. Learners explore cyber-physical systems, IoT sensor architectures, data engineering, 3D/4D visualization, physics-based and data-driven models, AI/ML analytics, anomaly detection, predictive maintenance, digital twin-enabled grid optimization, renewable forecasting, energy storage optimization, cybersecurity, interoperability, and sustainability analytics. Practical case studies demonstrate how digital twins can support real-world energy challenges such as equipment degradation, renewable intermittency, grid congestion, asset health monitoring, demand forecasting, and operational resilience. Recent research highlights the growing integration of AI with digital twins for predictive maintenance and renewable-dominated grid optimization, while also emphasizing challenges around data quality, scalability, cybersecurity, interoperability, and model transparency.

Programme Curriculum

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Course Duration

5 days

Course Objectives

By the end of the training, participants will be able to:

1. Understand Energy Digital Twin Fundamentals and the evolution of digital-twin architectures.
2. Design AI-powered Digital Twin architectures for energy assets and systems.
3. Integrate IoT, IIoT, SCADA, smart meters, sensors, and real-time operational data.
4. Develop data-driven, physics-based, and hybrid Digital Twin models.
5. Apply Machine Learning and Predictive Analytics to energy asset performance.
6. Implement Predictive Maintenance and Condition-Based Monitoring strategies.
7. Use Digital Twins for renewable-energy forecasting and optimization.
8. Apply Digital Twin technologies to smart grids, microgrids, and distributed energy resources (DERs).
9. Optimize battery energy storage systems (BESS) and energy flexibility.
10. Apply AI-driven anomaly detection, fault diagnosis, and asset health scoring.
11. Understand edge computing, cloud platforms, APIs, interoperability, and digital-thread technologies.
12. Implement cybersecurity, data governance, AI governance, and model-risk controls for digital-energy environments.
13. Develop a practical Energy Digital Twin roadmap and business case focused on operational efficiency, resilience, sustainability, and ROI.

Target Audience

1. Energy and Utility Executives
2. Power Generation Professionals
3. Grid and Utility Engineers
4. Renewable Energy Professionals
5. Asset Management and Maintenance Teams
6. Digital Transformation, Data, AI and IoT Professionals
7. Energy Consultants, Project Managers and Technology Leaders
8. Engineers, Researchers and Technical Specialists

Course Modules

Module 1: Energy Digital Twin Fundamentals and Digital Energy Transformation

- Digital Twin concepts, terminology, evolution and business value
- Physical assets, virtual models, cyber-physical systems and digital threads
- Energy-sector Digital Twin use cases across generation, grids and storage
- Digital Twin maturity models and digital transformation strategies
- Case Study: Digital Twin architecture for a renewable-energy power plant

Module 2: IoT, IIoT and Real-Time Energy Data Architecture

- IoT/IIoT sensor networks and connected energy assets
- SCADA, smart meters, historians, telemetry and operational technology data
- Real-time data ingestion, streaming analytics and event-driven architectures
- Edge computing, cloud computing and hybrid energy-data platforms
- Case Study: IoT-enabled predictive monitoring for wind turbines

Module 3: Digital Twin Modeling, Simulation and Visualization

- Physics-based, data-driven and hybrid Digital Twin models
- Asset, process, system and network-level modeling
- Simulation, scenario analysis and what-if modeling
- 3D visualization, dashboards, spatial analytics and asset hierarchy
- Case Study: Digital Twin for an integrated solar farm and battery system

Module 4: AI, Machine Learning and Predictive Analytics

- AI/ML algorithms for energy forecasting and optimization
- Time-series forecasting for demand, generation and asset behavior
- Anomaly detection, fault classification and asset health prediction
- Physics-informed AI, hybrid modeling and explainable AI
- Case Study: AI-driven predictive maintenance for power-generation equipment

Module 5: Digital Twins for Smart Grids and Renewable Energy

- Smart Grid Digital Twins and real-time grid intelligence
- Renewable forecasting for solar and wind generation
- Distributed Energy Resources (DERs), microgrids and virtual power plants
- Grid flexibility, congestion management and renewable curtailment reduction
- Case Study: AI-driven Digital Twin for a renewable-dominated power grid

Module 6: Predictive Maintenance, Asset Performance and Reliability

- Condition monitoring and predictive maintenance strategies
- Remaining Useful Life (RUL) estimation
- Failure prediction, root-cause analysis and anomaly detection
- Asset Performance Management (APM) and maintenance optimization
- Case Study: Digital Twin-enabled maintenance optimization for wind, solar and BESS assets

Module 7: Energy Optimization, Storage and Intelligent Operations

- AI-powered energy optimization and operational decision support
- Battery Energy Storage Systems (BESS) Digital Twins
- Demand forecasting, load optimization and energy flexibility
- Reinforcement learning, optimization algorithms and intelligent dispatch
- Case Study: Digital Twin optimization of a solar-plus-storage microgrid

Module 8: Cybersecurity, Interoperability, Governance and Digital Twin Strategy

- Digital Twin cybersecurity and cyber-physical risk management
- Data governance, data quality, identity and access management
- Interoperability, APIs, standards and legacy-system integration
- AI governance, model validation, transparency and responsible AI
- Case Study: Enterprise Energy Digital Twin implementation roadmap

Training Methodology

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
21 Sep 2026	25 Sep 2026	Online	$1,000
21 Sep 2026	25 Sep 2026	Physical	$1,500
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0

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