Digital Twin Technology for Solar Plants 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

Digital Twin Technology for Solar Plants Training Course provides a practical understanding of how Digital Twins, Artificial Intelligence (AI), Machine Learning (ML), IoT, SCADA, real-time analytics, predictive maintenance, cloud computing, and data-driven asset management can be integrated to create intelligent virtual representations of solar PV plants. Participants will explore how digital twin models can replicate physical solar assets, simulate operational conditions, detect performance deviations, optimize energy yield, and support faster, data-driven decision-making across the entire solar plant lifecycle.

The course focuses on the practical application of digital twin platforms for solar PV systems, including modules, inverters, trackers, transformers, weather stations, electrical systems, and balance-of-system assets. Through real-world case studies, predictive analytics, condition monitoring, performance optimization, fault diagnostics, simulation, and AI-powered forecasting, participants will learn how to move from conventional monitoring toward smart solar asset management. The program is suitable for professionals seeking to accelerate solar digitalization, operational excellence, renewable-energy innovation, predictive maintenance, and net-zero energy transformation.

Programme Curriculum

Digital Twin Technology for Solar Plants Training Course

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Course Duration

5 days

Course Objectives

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

1. Understand the fundamentals, architecture, and business value of Digital Twin Technology for solar plants.
2. Design digital twin frameworks for solar PV asset lifecycle management.
3. Integrate IoT sensors, SCADA, smart meters, weather stations, and operational data.
4. Apply AI and Machine Learning to solar plant performance optimization.
5. Develop real-time digital dashboards and asset visualization solutions.
6. Use digital twins for predictive maintenance and condition-based monitoring.
7. Identify equipment anomalies using AI-powered fault detection and diagnostics.
8. Optimize energy yield, availability, reliability, and plant performance.
9. Apply digital twin models to inverter, PV module, tracker, transformer, and BOS analysis.
10. Use data analytics and simulation to evaluate operational scenarios.
11. Develop strategies for predictive failure forecasting and asset health management.
12. Evaluate cloud, edge computing, cybersecurity, and data-integration requirements.
13. Build a roadmap for implementing smart, autonomous, and data-driven solar operations.

Target Audience

1. Solar PV Engineers and Design Engineers
2. Operations & Maintenance (O&M) Professionals
3. Renewable Energy Project Managers
4. Asset Managers and Energy Managers
5. SCADA, IoT, and Automation Engineers
6. Data Scientists, AI/ML Engineers, and Digital Transformation Professionals
7. Power Systems and Electrical Engineers
8. Renewable Energy Consultants, Developers, and Technology Leaders

Course Modules

Module 1: Digital Twin Fundamentals for Solar Energy

- Digital Twin concepts, evolution, architecture, and lifecycle applications
- Digital transformation of **solar PV plants and renewable-energy assets**
- Physical-to-digital asset representation and virtual plant modeling
- Digital Twin vs. conventional SCADA, monitoring, and simulation systems

- **Case Study:** Business value, ROI, scalability, and implementation challenges

Module 2: Solar Plant Digital Twin Architecture

- Digital Twin architecture for utility-scale and commercial solar PV plants
- Modeling **PV modules, strings, inverters, trackers, transformers, and BOS**
- Data layers, connectivity layers, analytics layers, and visualization layers
- **Case Study:** Integration of **SCADA, IoT, APIs, historians, GIS, and enterprise systems**
- Cloud, edge, and hybrid Digital Twin deployment strategies

Module 3: IoT, SCADA & Real-Time Data Integration

- IoT sensors and smart devices for solar asset monitoring
- SCADA data acquisition and real-time telemetry integration
- Weather, irradiance, temperature, wind, soiling, and environmental data
- Data quality, synchronization, normalization, and interoperability
- **Case Study: Edge computing and real-time streaming analytics** for solar plants

Module 4: AI, Machine Learning & Predictive Analytics

- AI/ML fundamentals for renewable-energy asset intelligence
- Solar generation forecasting and performance prediction
- **Anomaly detection and automated fault diagnosis**
- Predictive maintenance and remaining useful life estimation
- **Case Study:** AI-driven recommendations for plant optimization

Module 5: PV Performance & Energy Yield Optimization

- Digital modeling of PV module and inverter performance
- Performance Ratio, availability, degradation, and energy-yield analytics
- Identification of **underperformance, mismatch, shading, and soiling**
- Tracker optimization and dynamic operating-condition analysis
- **Case Study:** Digital Twin-based energy-loss analysis and optimization

Module 6: Predictive Maintenance & Asset Health Management

- Digital Twin applications for condition-based maintenance
- Inverter, transformer, tracker, cable, and PV module health monitoring
- Failure prediction and **early-warning systems**
- **Case Study:** Maintenance prioritization using asset criticality and risk analytics
- Reducing downtime, O&M costs, and unplanned failures

Module 7: Advanced Simulation, Visualization & Cybersecurity

- Real-time 3D and dashboard-based solar plant visualization
- What-if simulation and operational scenario modeling
- **Case Study:** Digital Twin applications for commissioning, troubleshooting, and optimization
- **Cybersecurity, data governance, access control, and secure connectivity**
- Digital Twin scalability, interoperability, and future autonomous operations

Module 8: Implementation, Case Studies & Digital Twin Roadmap

- Digital Twin implementation lifecycle from concept to deployment

- Technology selection, data strategy, KPIs, and business-case development
- **Case Study: Utility-scale solar plant predictive maintenance**
- **AI-enabled PV performance and energy-yield optimization**
- Developing a practical **Solar Digital Twin roadmap and implementation strategy**

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
23 Nov 2026	27 Nov 2026	Online	$1,000

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Physical	$1,500
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

Ready to enroll or request a customized program? Book online or contact us:

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