Utility-Scale Solar Power Plant Engineering 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

Utility-Scale Solar Power Plant Engineering Training Course is designed to develop practical, project-focused expertise in the design, engineering, construction, grid integration, commissioning, operation, and performance optimization of large-scale solar PV power plants. The course reflects current industry priorities such as energy transition, renewable energy integration, grid flexibility, battery energy storage systems (BESS), digitalization, advanced power electronics, grid-enhancing technologies, project bankability, and lifecycle asset management. These areas are increasingly important as solar generation expands and grid connection and flexibility become major engineering considerations.

Participants will follow an integrated engineering pathway covering solar resource assessment, PV system design, DC/AC sizing, inverter selection, electrical collection systems, substations, protection, SCADA, communications, civil and structural engineering, energy yield, grid-code compliance, commissioning, O&M, and techno-economic optimization. Practical case studies will connect engineering theory with real-world utility-scale project challenges, including grid congestion, hybrid solar-plus-storage configurations, and renewable energy integration. The methodology combines technical instruction, worked examples, engineering exercises, case-based learning, group problem-solving, simulations, and project-style assessments.

Programme Curriculum

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Course Objectives

1. Analyze solar resource data and develop bankable utility-scale PV energy-yield assumptions.
2. Design utility-scale PV arrays using appropriate module technologies, DC/AC ratios, string configurations, and inverter architectures.
3. Apply PV system engineering principles to optimize plant capacity, energy yield, availability, and performance ratio.
4. Develop electrical single-line diagrams covering LV, MV, collector, transformer, and grid-interconnection systems.
5. Evaluate inverter, transformer, switchgear, protection, and power-quality requirements.
6. Perform grid-connection and grid-code compliance assessments for large renewable power plants.
7. Understand SCADA, monitoring, communications, cybersecurity, and digital O&M requirements.
8. Integrate battery energy storage systems (BESS) with utility-scale solar projects for flexibility and energy shifting.
9. Conduct energy-yield, loss, degradation, and performance-ratio analysis using engineering models.
10. Apply LCOE, CAPEX/OPEX, financial modeling, and techno-economic optimization principles to project decisions.
11. Identify and mitigate construction, commissioning, HSE, quality, and project execution risks.
12. Develop effective operation, maintenance, predictive maintenance, and asset-management strategies.
13. Evaluate emerging grid-enhancing technologies, hybrid renewable systems, digital twins, AI-enabled analytics, and advanced renewable integration opportunities.

Target Audience

1. Solar PV project engineers and electrical engineers
2. Renewable energy developers and project managers
3. EPC contractors and engineering consultants
4. Utility and grid-planning professionals
5. Operations and maintenance engineers
6. Energy consultants, investors, and technical due-diligence teams
7. Government, regulatory, and energy-sector professionals
8. Engineering graduates and technical professionals entering the utility-scale solar industry

Course Modules

Module 1: Utility-Scale Solar Project Development & Engineering Fundamentals

- Utility-scale PV project lifecycle
- Site selection, land constraints, permitting, environmental considerations, and infrastructure assessment.
- Solar resource assessment, meteorological data, irradiation databases, and uncertainty.
- Project capacity definition, technology selection, **DC/AC ratio**, and preliminary plant architecture.
- **Case Study:** Preliminary engineering strategy for a large-scale PV project balancing land availability, energy yield, grid capacity, and project cost.

Module 2: PV Plant Design, Layout & Energy Yield

- PV module technologies, string design, array configuration, trackers, fixed-tilt systems, and mismatch considerations.
- DC design, cable sizing, voltage drop, combiner architecture, and DC losses.
- Inverter selection, centralized versus string inverter architectures, clipping, and conversion efficiency.
- Plant layout optimization for **energy yield, land utilization, maintainability, and constructability**.
- **Case Study:** Optimization of a utility-scale solar layout using energy yield, DC/AC ratio, shading, and land-use trade-offs.

Module 3: Electrical Engineering & Grid Interconnection

- MV collection systems, transformers, switchgear, substations, and grid-interconnection architecture.
- **Protection coordination**, grounding/earthing, lightning protection, short-circuit studies, and equipment ratings.
- Reactive power, voltage control, frequency response, harmonics, power factor, and power-quality requirements.
- Grid-code compliance, interconnection studies, power-flow analysis, and curtailment considerations.
- **Case Study:** Engineering response to a solar project facing limited grid-hosting capacity and connection constraints.

Module 4: Civil, Structural & Construction Engineering

- Site grading, drainage, roads, foundations, fencing, access, and geotechnical considerations.
- Tracker and fixed-structure engineering, wind loading, corrosion, material selection, and structural reliability.
- Construction sequencing, logistics, material handling, installation productivity, and quality control.
- **EPC management**, interface coordination, inspection, testing, and construction risk management.
- **Case Study:** Construction planning for a large PV site with challenging terrain, weather constraints, and logistics requirements.

Module 5: SCADA, Monitoring, Automation & Digital Solar Engineering

- Plant-level SCADA architecture, data acquisition, sensors, meters, weather stations, and communications.
- Monitoring of **availability, performance ratio, energy yield, alarms, and equipment health**.
- Remote operations, data analytics, dashboards, digital workflows, and predictive maintenance.
- Introduction to **AI-enabled diagnostics, machine learning, digital twins, and condition-based maintenance**.
- **Case Study:** Using plant operating data to identify underperformance, classify losses, and prioritize corrective maintenance.

Module 6: Battery Energy Storage & Hybrid Solar Power Plants

- BESS fundamentals: batteries, PCS, EMS, thermal management, protection, and auxiliary systems.
- Solar-plus-storage architectures, AC-coupled versus DC-coupled configurations, and hybrid plant controls.
- Energy shifting, peak support, ancillary services, congestion management, and renewable integration.
- BESS sizing concepts, duration, degradation, availability, operational constraints, and lifecycle considerations.
- **Case Study:** Solar-plus-BESS project designed to shift daytime PV generation into higher-value evening periods; energy shifting has become a dominant application for new utility-scale battery projects.

Module 7: Performance, Commissioning, O&M & Asset Management

- Commissioning procedures, inspection, testing, punch lists, energization, and handover.
- Performance testing, acceptance criteria, **PR testing**, availability assessment, and energy-yield verification.
- Preventive, corrective, and predictive maintenance strategies for modules, inverters, transformers, trackers, and substations.
- Asset management, degradation analysis, spare-parts planning, warranty management, and lifecycle optimization.
- **Case Study:** Root-cause analysis of declining plant performance using availability, inverter, irradiation, and energy-yield data.

Module 8: Project Economics, Bankability & Advanced Solar Engineering

- **CAPEX, OPEX, LCOE, IRR, NPV, PPA structures**, sensitivity analysis, and financial risk.
- Bankability requirements, technical due diligence, warranties, performance guarantees, and EPC/O&M contracts.
- Risk assessment covering technology, grid connection, construction, financing, resource, and operational risks.
- Emerging technologies
- **Case Study:** Technical due diligence and investment assessment of a utility-scale PV-plus-BESS project, including energy yield, grid risks, degradation, O&M, and financial sensitivity.

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
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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