CONCEPT

Solar PV Plant Design, Commissioning and O&M: Utility-Scale Photovoltaic Engineering

7 – 11 November 2027
Dammam - Eastern Province five-star



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Ref: 633_18213 **Date:** 7 – 11 November 2027 **Location:** Dammam - Eastern Province five-star **Fees:** 19500 SAR

Introduction:

Solar PV plant design errors surface long after financial close: strings that exceed inverter voltage windows on cold mornings, undersized DC cables that erode yield, combiner fuses that nuisance trip, and plants handed over without baseline IV curves, so later faults cannot be traced. This Core Concept course trains engineers to size, wire, commission and operate utility-scale photovoltaic plants to a measurable performance ratio, from module datasheets and tracker rows to the medium-voltage collection system and the substation interface. Participants build a PV Plant Layout, Sizing and O&M Plan for a case utility-scale project.

Course Objectives:

- Convert irradiance data and module datasheet parameters into a block-level energy yield estimate with an itemised loss chain
- Size PV strings, combiner boxes and central or string inverters against temperature-corrected voltage and current limits
- Specify DC cabling, overcurrent protection, surge protection and earthing for PV arrays in line with IEC 60364 practice
- Design the medium-voltage collection system and substation interface to meet generic grid connection requirements
- Run and interpret commissioning tests including IV curve tracing, insulation resistance measurement and infrared thermography
- Set an O&M plan with cleaning intervals, performance ratio and availability KPIs and a fault diagnosis routine for degradation

Target Audience:

- Electrical engineers who size strings, inverters, cables and protection for ground-mounted PV plants
- Renewables engineers who prepare layouts, yield estimates and design reviews for utility-scale solar projects
- Commissioning engineers who test arrays, inverters and switchgear before handover
- Asset and performance engineers who track plant output, availability and degradation after commercial operation
- O&M engineers who plan module cleaning, inspections and corrective maintenance across large PV fields

Course Outline:

Day 1: Solar Resource, Module Technology and Plant Configuration

- Irradiance Data Sets: Global Horizontal, Direct Normal and Plane-of-Array Transposition
- Module Datasheet Reading: STC Ratings, Temperature Coefficients and Warranty Degradation Curves
- Cell Technology Comparison: Monofacial, Bifacial and Thin-Film Modules for Hot Dusty Sites
- Fixed Tilt versus Single-Axis Tracker Rows: Pitch, Ground Coverage Ratio and Backtracking
- Plant Block Configuration: Hectares per Megawatt, Inverter Station Placement and Access Roads

Day 2: String Sizing, Inverter Architecture and DC Electrical Design

- String Length Calculation from Cold-Morning Open-Circuit Voltage and Hot-Day MPP Voltage
- Central versus String Inverter Selection: MPPT Windows, Block Size and Spares Strategy
- DC/AC Loading Ratio and Inverter Clipping Assessment
- Combiner Box Design: String Fuses, DC Isolators, Surge Protective Devices and Monitoring Cards
- DC Cable Sizing for Ampacity and Voltage Drop Using Solar Cable Derating Tables

Day 3: AC Collection, Grid Interface and Energy Yield Loss Chain

- Inverter Transformer Stations and Medium-Voltage Collection Ring or Radial Feeder Layouts
- Substation Interface: Main Transformer, Metering Point and Protection Relay Coordination
- Generic Grid Connection Requirements: Reactive Power Capability, Voltage Ride-Through and Active Power Curtailment
- Yield Loss Chain from Irradiance to Export Meter: Soiling, Thermal, Mismatch, Ohmic and Availability Losses
- PV Plus Storage Coupling Overview: AC-Coupled versus DC-Coupled Configurations

Day 4: Commissioning Tests, Monitoring, Degradation and Fault Diagnosis

- Cold Commissioning Checks: Polarity, String Open-Circuit Voltage and Insulation Resistance Measurement
- IV Curve Tracing and Irradiance-Corrected Comparison Against Datasheet Curves
- Infrared Thermography and Electroluminescence Findings: Hot Spots, Bypass Diode Failure and Cracked Cells
- Monitoring Data Acquisition: Plant Controller, Weather Station Sensors and Performance Ratio Dashboards
- Degradation Rate Estimation and Underperformance Root Cause Tree for Strings and Inverters

Day 5: Case PV Plant Build: Layout, Sizing and O&M Plan

- Case Project Briefing: Site Irradiance File, Land Boundary and Grid Connection Offer
- Array Layout and String-to-Inverter Sizing Workbook for the Case Plant
- Soiling Rate Analysis and Module Cleaning Interval Cost Trade-Off Model
- O&M Schedule with Preventive Tasks, Spare Parts List and Availability KPIs
- PV Plant Layout, Sizing and O&M Plan Presentation and Peer Challenge

Skills You Will Gain:

- PV String Sizing
- Inverter Architecture Selection
- DC Protection Design
- Medium-Voltage Collection Layout
- Yield Loss Budgeting
- IV Curve Interpretation
- Thermographic Fault Detection
- Soiling and Cleaning Optimisation

Why Attend This Course:

- Return with a PV Plant Layout, Sizing and O&M Plan built in a working sizing workbook for a case utility-scale project
- Catch string voltage, clipping and cable sizing errors before they are built into thousands of identical strings
- Hand over plants with baseline test records that make later faults traceable to a string, combiner or inverter
- Compare design and operating practice with engineers from developers, EPC contractors, utilities and O&M providers

Conclusion:

A photovoltaic plant earns its forecast only when module choice, string and inverter sizing, DC protection, collection design and commissioning evidence fit together, and when operators act on performance data. The course moves from irradiance data and datasheets through DC electrical design and the grid interface to commissioning tests, monitoring and fault diagnosis. The final day applies these methods to a case plant and produces a PV Plant Layout, Sizing and O&M Plan ready for design review or operational handover.