

Small and Large-Scale Solar photovoltaic systems

Theory, design, components Selection, Installation, Commissioning & Maintenance

OVERVIEW

Load shedding has become a persistent challenge in South Africa, driving renewed interest in reliable and sustainable alternative energy solutions. While traditional stop-gap measures such as lanterns and generators have resurfaced, solar photovoltaic (PV) energy has emerged as a practical, long-term solution capable of significantly reducing reliance on fossil fuels.

This technical training course has been specifically developed to meet the growing demand for clear, practical, and standards-compliant guidance on the design, selection, and installation of solar PV system components. The programme aligns with key national and international standards, including:

- SANS 10142-1:2021 (Section 7.12)
- SANS 60364-7-712:2018 (Edition 2)
- IEC 60364-7-712:2017 (Edition 2)
- SANS 61215

BENEFITS OF ATTENDING

By attending this course, delegates will gain the knowledge and practical insight to:

- Understand the fundamental principles of solar photovoltaic (PV) systems
- Identify and compare different PV cell types and technologies, including their performance characteristics and applications
- Select, size, and install key PV system components in accordance with applicable standards
- Apply best practices for battery and charge controller selection and sizing
- Correctly size inverters based on system demand and operational requirements
- Comply with PV wiring and installation requirements, including protection and safety considerations
- Perform accurate cable selection and sizing to ensure efficiency, reliability, and compliance
- Assess solar site conditions and select appropriate mounting structures for optimal system performance
- Conduct PV system commissioning, testing, and routine maintenance to ensure long-term reliability and performance

WHO SHOULD ATTEND?

- Electrical Engineers/Technicians/Technologists
- Electrical reticulation Supervisors/Technicians,
- Distribution system planners,
- Maintenance managers,
- Building planners/managers.
- Electrical workers

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INTRODUCTION

- Overview of PV system standards
- Energy from the sun
- How can we harness this abundant solar energy
- Solar heating: Active and passive systems

SOLAR PHOTOVOLTAIC THEORY

- Mechanism of generation
- The direction of current inside the PV cell
- Various types of PV cell
- Photovoltaic (PV) Hierarchy
- External cell parameters
- Types and Conversion Efficiency of Solar Cell
 - Single-crystal or Mono-crystalline Silicon
 - Polycrystalline or Multi-crystalline Silicon
- Current-Voltage (I-V) Curve
- Estimating obtained power by I - V curve
- I / V curve vs Insolation intensity
- Effects of Temperature
- Temperature and efficiency
- Effects of Shading/Low Insolation
- Shading on Modules
- Maximum power point tracking
- Exercises

SMALL-SCALE PV SYSTEM COMPONENTS, SELECTION AND INSTALLATION

- PV System Components
 - Solar charge controller
 - Inverter,
 - Battery bank,
 - Loads (appliances).
 - circuit breakers, and
 - a mounting structure
- Photovoltaic units
 - PV cells
 - Solar module
 - PV modules
 - Solar panel
 - Solar array
- Calculating the correct panel size
 - Calculating total watt-hours needed from the panels each day
 - Estimating the energy output from a solar panel
 - Fudge factor
 - Panel Generation Factor
 - Adjusting the generation factor for different climates
 - Finding the number of panels needed
- **Batteries**
 - Battery Basics
 - Battery Capacity
 - Batteries in Series and Parallel
 - Battery Basic terms
 - Rate of Charge or Discharge – Battery C-rate
 - Battery classification
 - Types of batteries commonly used in PV systems
 - BATTERY Sizing and selection
 - Grid-Tied System (With Batteries)
- **Charge Controllers**
 - Controller Basics
 - PWM charge controller
 - MPPT charge controller
 - Additional Controller Features
 - Other Controller Considerations
 - Controller sizing

- **Inverters**
 - Inverter Basics
 - Single-phase full-bridge inverter
 - Three-phase full-bridge inverter
 - Pulse-width modulation
 - Specifying an Inverter
 - Brands of inverters in South Africa
 - Micro-inverter
 - Synchronverters
- **PV Wiring and installation requirements**
 - Tools
 - Series Connections
 - Parallel Connections
 - Cables and Connectors
 - Cable Sizing
 - Safety Equipment
 - Overcurrent Protection
 - Grounding
- **SANS10142-1 compliance requirements**
 - DC conductors and battery protection methods
 - additional requirements for PV off-grid or on-grid installations
 - Additional requirements for PV installations as an alternative to the main supply
- **Solar Site & Mounting**
 - Altitude and Azimuth
 - Solar Pathfinder
 - Site Selection – Tilt Angle
 - Solar Access
 - General Considerations
 - Mounting structure
 - Basic Mounting Options
 - Pole Mount Considerations
 - Tracking Considerations
 - Passive Vs. Active
 - Roof Mount Considerations
- Categories of PV systems
 - Autonomous / Off-Grid system
 - hybrid and
 - grid-connected / Grid-Tied system
- Installation example
- Exercises

LARGE-SCALE (SOLAR FARM) DESIGN

- Selection of site
- Solar farm design
- PV simulation and design software
- PV plant layout design
 - General layout
 - Tilt angle
 - PV module configuration
 - Inter-row spacing
 - Orientation
- Technology selection
 - Modules
 - Inverters
 - Transformers
 - Mounting structures
- DC system design
- PV array design
 - Single string PV Array
 - Multiple parallel string PV Array
 - Module, String and Array Voltage & Current
 - SANS 60364-7-712:2018 requirements for Module, String and Array Voltage & Current
 - Worked examples and exercises
 - Maximum number of modules in a string
 - Minimum number of modules in a string
 - Maximum number of strings
 - Cable selection and sizing in accordance with SANS10142-

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Live online training | 6th - 7th August 2026| **R 8 999 per delegate**

Booking Contact (Approving Official) Mr/Mrs/Ms

Full Names: _____

Company name: _____

Direct Tel No: _____ E-mail: _____ Fax: _____

VAT No: _____

Address: _____

Signature _____

Person Responsible for Finance: _____ Direct Tel No: _____ Date of Payment: _____

BANKING DETAILS:

Independent Training Management Pty Ltd
Bank: FNB South Africa
Account Number: 62685879276
Branch Code: 251650
Branch: Randburg

THE FOLLOWING HEREBY CONFIRM ATTENDANCE TO THE WORKSHOP

Delegate1: Names _____

Position: _____ E-Mail: _____

Delegate 2: Names _____

Position: _____ E-Mail: _____

Delegate 3: Names _____

Position: _____ E-Mail: _____

Delegate 4: Names _____

Position: _____ E-Mail: _____

Delegate 5: Names _____

Position: _____ E-Mail: _____

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