



PB INSTITUTE OF RESEARCH AND TECHNOLOGY

P.O Box 21457-00100

Nairobi - Kenya

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Advanced Solar Photovoltaic (PV) Systems Design

Duration: 10 days

On-Site

01 Who Should Attend

- This course is ideal for;
- Solar PV System Engineers
- Renewable Energy Consultants
- Electrical Design Professionals
- Project Managers (Solar)
- Energy Efficiency Specialists
- Advanced Solar Installers
- Sustainability Engineers
- BIPV Designers
- Grid Interconnection Specialists
- Solar Energy Researchers
- Technical Sales Engineers (Solar)
- Energy Storage System Integrators
- Architectural Engineers



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02 About the Course

As utility-scale and commercial solar installations become increasingly complex, relying on basic sizing rules is no longer sufficient to guarantee long-term system reliability and financial returns. Our **Advanced Solar Photovoltaic (PV) Systems Design Training Course** meets this engineering challenge by equipping solar engineers, project developers, and technical leads with expert-level skills to design and optimize complex grid-tied, off-grid, and hybrid solar configurations. Guided by solar engineering specialists, participants will master advanced modeling software, site micro-siting assessments, balance-of-system (BOS) optimization, and battery energy storage integration. By combining rigorous technical design with economic feasibility and grid interconnection protocols, this program prepares technical professionals to minimize system losses, maximize energy output, and deliver bankable, high-performance solar assets.



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03 Workshop Objectives

- Master advanced PV system design principles for grid-tied, off-grid, and hybrid configurations.
- Utilize advanced design software for PV system modeling, simulation, and optimization.
- Conduct detailed site assessments and calculate precise energy yield for complex installations.
- Design and integrate energy storage solutions to enhance PV system reliability and performance.
- Apply advanced optimization techniques to maximize PV system efficiency and energy output.
- Develop PV system designs for diverse applications, including residential, commercial, and industrial.
- Navigate grid interconnection requirements and ensure compliance with relevant standards.
- Perform comprehensive technical and economic feasibility studies for advanced PV projects.
- Implement effective troubleshooting and maintenance strategies for advanced PV systems.
- Analyze and measure the performance of advanced PV systems using data analytics and monitoring tools.
- Model and simulate complex PV systems using industry-standard software for performance prediction.
- Design and integrate building-integrated PV (BIPV) systems for enhanced architectural and energy efficiency.
- Understand and comply with legal and regulatory considerations for advanced PV installations.

04 Module Topics

Module 1: Advanced PV System Fundamentals:



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- System components and interactions
- Advanced electrical design principles
- Performance modeling and simulation
- Environmental considerations
- Safety standards and best practices

Module 2: Grid-Tied System Design & Optimization:

- Grid interconnection requirements
- Inverter sizing and selection
- Voltage regulation and grid stability
- Performance monitoring and analysis
- Grid compliance and permitting

Module 3: Off-Grid System Design & Sizing:

- Load analysis and energy demand estimation
- Battery sizing and selection
- Charge controller selection and configuration
- System reliability and redundancy
- Remote monitoring and control

Module 4: Hybrid PV & Energy Storage Solutions:

- Hybrid system configurations and applications
- Energy storage integration strategies
- Microgrid design and management
- Load shifting and demand management
- System optimization for hybrid scenarios

Module 5: Advanced PV Design Software Mastery:



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- Software interface and functionality
- 3D modeling and shading analysis
- Electrical simulation and performance prediction
- Report generation and documentation
- Customization and advanced features

Module 6: Energy Storage Integration & Management:

- Battery technologies and characteristics
- Energy storage system sizing and selection
- Battery management systems (BMS)
- Integration with PV systems and inverters
- Energy storage performance optimization

Module 7: System Performance Optimization Techniques:

- MPPT algorithms and optimization
- Shading mitigation strategies
- Temperature management and cooling
- Soiling and maintenance optimization
- Data-driven performance analysis

Module 8: Site Assessment & Yield Analysis:

- Site survey and data collection
- Shading analysis and solar resource assessment
- Energy yield estimation and modeling
- Performance ratio calculation
- Weather data analysis

Module 9: Grid Interconnection & Compliance:



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- Grid interconnection standards and regulations
- Voltage and frequency regulation
- Protection and safety requirements
- Permitting and approval processes
- Communication and control systems

Module 10: Technical & Economic Feasibility Analysis:

- Cost estimation and financial modeling
- Return on investment (ROI) calculation
- Payback period analysis
- Life cycle cost analysis
- Sensitivity analysis and risk assessment

Module 11: Regulatory & Legal Frameworks:

- National and local regulations
- Permitting and zoning requirements
- Environmental impact assessments
- Incentive programs and policies
- Contractual agreements and warranties

Module 12: Advanced PV System Troubleshooting:

- Fault detection and diagnosis
- Electrical testing and measurement
- Component replacement and repair
- Remote troubleshooting and support
- Preventative maintenance strategies

Module 13: Performance Measurement & Analytics:



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- Data acquisition and monitoring systems
- Performance data analysis and interpretation
- Reporting and visualization tools
- Performance benchmarking and optimization
- Data-driven decision making

Module 14: PV System Modeling & Simulation:

- Software modeling techniques
- Simulation of system behavior
- Performance prediction and optimization
- Scenario analysis and design validation
- Model calibration and validation

Module 15: Building Integrated PV (BIPV) Design:

- BIPV system types and applications
- Architectural integration and aesthetics
- Electrical and mechanical integration
- Thermal performance and energy efficiency
- Building codes and standards