# Noltrix Training Academy

## SAPVIA PV GreenCard Training Program

NOLTRIX
TRAINING ACADEMY

**Noltrix Training Academy (Pty) Ltd**
Registration No: 2023/762759/07
VAT Reg No: 4240314833

PV GreenCard Training Program
Document No. NTX-921000-111
Rev.2025.1.0

**Head Office Address:**
121 Melt Marais Str
Annlin, Pretoria, 0182

# Day 1

## INTRODUCTIONS

A. Welcoming & Introduction
B. Morning refreshments

## THEORY

### 1.1. BASIC ELECTRICITY

1.1.1. Units & Symbols
1.1.2. Ohms Law – Explaining both triangles
1.1.3. Kirchhoff's Current & Voltage rule – explain
1.1.4. Series & Parallel circuit calculations
1.1.5. Understanding I-V curves including diodes
1.1.6. Explain current at low and high resistance
1.1.7. AC and DC curves – explain why DC is dangerous (sinewave going through zero)
1.1.8. Explain N/E bonding

### 1.2. IRRADIATION – CELLS – MODULES

1.2.1. Nersa, Eskom and Municipalities
1.2.2. NRS097 & SANS10142
1.2.3. Explain Stand Alone, Grid-Tied and Hybrid Inverters
1.2.4. Schematics to explain difference between inverters
1.2.5. Where was solar modules first used – Space
1.2.6. Explain what Airmass means
1.2.7. Explain the terms STC & NOCT and their parameters
1.2.8. Explain Global Irradiation & Albedo Effect
1.2.9. Explain short time irradiation – spikes
1.2.10. Explain irradiation differences between JHB and CPT

### 1.3. CELLS

1.3.1. Explain difference between Mono & Crystalline modules
1.3.2. Explain what a Diode is and how it functions
1.3.3. Explain the purpose of a MPPT and how it works
1.3.4. Explain Fill factor
1.3.5. Supply list of all abbreviations
1.3.6. Series – Voltage & Current behavior
1.3.7. Parallel – Voltage & Current behavior

### 1.4. MODULES

1.4.1. Number of Cells – 60 or 72 full cells
1.4.2. Number of cells – 120 or 144 half cells
1.4.3. Busbars
1.4.4. Warranties & Guarantees
1.4.5. Tolerance ±5%

## PRACTICAL

A. Explanation and Demonstration of Tools

# DAY 2

## THEORY

### 2.1. SHADING

2.1.1. Explain function of Bypass diode
2.1.2. Explain the reason of half cells – shading
2.1.3. Unavoidable & mutual shading
2.1.4. Shading effect on angled installation
2.1.5. Reduction of shading losses – ensure that shaded modules are connected to 1 string only

### 2.2. INVERTERS

2.2.1. Identical strings to be connected in parallel
2.2.2. Explain what determines amount of power – qty of modules, series or parallel
2.2.3. Quantity of modules in series determines total Voltage
2.2.4. Quantity of strings in parallel determines total Current
2.2.5. Purpose of an Inverter
2.2.6. Explain qty of MPPT's inputs on inverter
2.2.7. Purpose of Safety Devices & Isolators
2.2.8. Purpose of Monitoring of Inverter data
2.2.9. High & low Frequency Inverters – explain pros and cons
2.2.10. Explain Apparent and True Power
2.2.11. Explain Pure and Modified Sinewave
2.2.12. Explain why monitoring of system is important
2.2.13. RTFM, Data sheets & installation manuals Importance
2.2.14. Explain IP65, Ingress protection
2.2.15. Explain Anti-Islanding
2.2.16. Explain Notified Maximum Demand, 25% and 75%
2.2.17. Less modules in series – low voltage / more modules in series – high voltage
2.2.18. Explain Micro Inverters & Optimizers
2.2.19. Multi-string inverter – inverter with 2 or more MPPT's
2.2.20. Direct connection to wall socket – explain why it is possible
2.2.21. Explain AC & DC Coupled
2.2.22. Explain difference between lead acid and lithium batteries
2.2.23. Explain why we use 0°C and 70°C temperature when we do our calculations
2.2.24. Explain how PVGIS works for the new carport structure

### 2.3. STANDARDS & GUIDELINES

2.3.1. Grid code NRS097, Wiring standard SANS10142, Structural SANS10160
2.3.2. Explain BOS
2.3.3. Reverse current – 2 string or more in parallel, strings must be fused
2.3.4. Purpose of DC Combiner box
2.3.5. String fuses – minimum and maximum ratings
2.3.6. Cable Routing
2.3.7. Cable Crimping
2.3.8. PV cables must not be exposed to the elements
2.3.9. Explain PV wire current rating in different scenarios

# DAY 3

## THEORY

### 3.1. Planning Process

3.1.1. Fire prevention
3.1.2. Labelling
3.1.3. Protection
3.1.4. Earthing
3.1.5. Bonding

### 3.2. MOUNTING

3.2.1. Types of different mounting situations
3.2.2. Confirm that roof maintenance has been completed before installing modules.
3.2.3. Inclination of modules influences output
3.2.4. Explain what is a rail, rail connector, roof hook, mid clamp and end clamp
3.2.5. Explain portrait and landscape mode
3.2.6. Explain Ballasts, Anchored and Attached – where would you use them
3.2.7. PU2000/cable trays and anti-theft brackets
3.2.8. Don't mix metals – Galvanic and bimetallic corrosion occurs
3.2.9. After installation and commissioning, owner has legal duty to maintain safety
3.2.10. Structural design of roof (SANS10160) – engineers might have to sign off.
3.2.11. Clamping zones
3.2.12. Explain why 400mm and 500mm from edges of roof are important
3.2.13. Health & Safety – explain difference between Safety Plan and Safety File
3.2.14. Explain difference between Fall Prevention and Fall Arrest
3.2.15. Mention lifespan on safety harnesses
3.2.16. Rail length calculations
3.2.17. Illustrate different bonding methods – mid clamps with spike / potential equalizing clips

### 3.3. COMMISSIONING

3.3.1. Explain what to test BEFORE SWITCHING ON a system
3.3.2. Explain what to test AFTER SWITCHING ON a system
3.3.3. Explain what a Test Report is
3.3.4. Explain who can issue a CoC
3.3.5. Explain cable layout

## PRACTICAL

A. Explaining the Wiring of a Grid Tied Inverter
B. Soil Resistance Test

## DAY 4

### THEORY

### 4.1. CALCULATIONS

4.1.1. Grid Tied Inverter Calculations
4.1.2. Match Kodak inverter with 210W Module @STC
4.1.3. Match Kodak inverter with 210W Module @0°C
4.1.4. Match 6kW Sungrow inverter with 210W Module @STC
4.1.5. Match 6kW Sungrow inverter with 210W Module @0°C
4.1.6. Hybrid with Storage Calculations – 24Hrs
4.1.7. Hybrid with Storage Calculations – Final

### PRACTICAL

A. Wiring of Grid Tied Inverter

## DAY 5

### THEORY

### 5.1. SINGLE LINE DIAGRAM (SLD)

5.1.1. SLD on grid-tied installation
5.1.2. SLD on hybrid – all loads connected to inverter
5.1.3. SLD on hybrid – essential and non-essential loads

### 5.2. JOB COSTING / BILL OF MATERIALS

5.2.1. Demonstrate the format of how it will be asked in the exam
5.2.2. Revision of Self-assessment and Pre-assessment papers
5.2.3. Add students to Noltrix Support Group
5.2.4. Explain procedure to register at PV GreenCard
5.2.5. Explain procedure to view certificates and to upload ID document

### PRACTICAL

A. Introducing all tools needed for installation and commissioning
B. Rail length calculations
C. Check modules Voc
D. Mounting of modules on roofs
E. Check levelling
F. Check alignment
G. Soil resistance checks
H. Insulation checks