



Republic of the Philippines

Department of Education

DepEd Complex, Meralco Avenue, Pasig City

STRENGTHENED SENIOR HIGH SCHOOL CURRICULUM

PHOTOVOLTAIC SYSTEMS INSTALLATION

Grade 11/12

Course Description:

This course equips learners with essential skills for Photovoltaic Systems Installation, focusing on interpreting circuit design, installation, and maintenance of solar energy systems, aligning with the Philippines' growing emphasis on sustainability and renewable energy under the Renewable Energy Act of 2008 (RA 9513). Upon completion, learners are eligible to take assessments to earn National Certificate level II in PV System Installation, higher education, and careers relative to the renewable energy industry sector.

Elective: Technical Professional

Prerequisite: None

Time Allotment: In Grade 11, 320 hours for two semesters, 8 hours per week. In Grade 12, 320 hours for one semester, 16 hours per week

Schedule: First/Second Semester

QUARTER 1

CONTENT STANDARD	The learners demonstrate an understanding of the concepts and principles of solar energy system in Photovoltaic (PV) Systems Installation.	
PERFORMANCE STANDARD	The learners perform site assessment with safety precautions.	
LEARNING COMPETENCIES	CONTENT	
1. Discuss the concepts and principles related to Photovoltaic Systems Installation.	Overview of Renewable Energy and Solar Power <ul style="list-style-type: none"> • RA 9513 Photovoltaic (PV) Systems <ul style="list-style-type: none"> • Types • Benefits and Applications Career/Entrepreneurial opportunities	
2. Discuss checklist for installation parameters.	Installation checklist <ul style="list-style-type: none"> • System requirements • Wiring and cable sizing 	

3. Perform site assessment procedures.	Site Assessment Procedures <ul style="list-style-type: none"> • Site selection criteria • Mounting system considerations • (PV) Electrical load calculation
4. Report completion of work.	Documentation and report

QUARTER 2

CONTENT STANDARD	The learners demonstrate an understanding of the concepts and principles of solar energy system in Photovoltaic (PV) Systems Installation.	
PERFORMANCE STANDARD	The learners perform PV components inspection with safety precautions.	
LEARNING COMPETENCIES	CONTENT	
1. Perform inspection of PV components, materials and measuring instruments compliance.	PV Components and Materials <ul style="list-style-type: none"> • Components and materials standards (IEC, UL, PEC) • Measuring instruments • Manufacturer's manual • Electrical specifications Inspection of PV Components, Tools, Instruments and Materials <ul style="list-style-type: none"> • Testing • Maintenance • Storage 	
2. Conduct reporting of test results of PV components and materials.	Documentation and Report	

QUARTER 3

CONTENT STANDARD	The learners demonstrate an understanding of the concepts and principles of Photovoltaic (Solar Energy) Systems Installation.	
PERFORMANCE STANDARD	The learners perform photovoltaic (solar energy) systems installation with safety precautions.	
LEARNING COMPETENCIES	CONTENT	
1. Discuss safety protocols for PV systems installation.	Safety protocols for PV systems installation <ul style="list-style-type: none"> • Electrical safety • Site safety • Working at Heights • Fire safety and Emergency Protocols 	
2. Determine the PV installation layout, tools, and materials.	PV Systems Installation <ul style="list-style-type: none"> • Wiring diagrams and layout 	
3. Perform installation of photovoltaic systems.	PV Systems Installation Procedures <ul style="list-style-type: none"> • Mounting and racking system • Panel installation • Inverter installation • Battery installation • Electrical wiring connections • Corrective measures 	
4. Report completion of work.	Documentation and report	

QUARTER 4

CONTENT STANDARD	The learners demonstrate an understanding of the concepts and principles of Photovoltaic (Solar Energy) Systems Installation.	
PERFORMANCE STANDARD	The learners perform commissioning of photovoltaic (solar energy) systems with safety precautions.	
LEARNING COMPETENCIES	CONTENT	
1. Apply commissioning procedures on wiring, grounding, and system components.	PV Systems Commissioning <ul style="list-style-type: none"> • Pre-Commissioning Checks (Wiring, Grounding, Polarity) • System Testing (Voltage, Current, Power Output) 	
2. Manage the results of commissioning photovoltaic systems.	Final Inspection and Handover Documentation	

Glossary

AC (Alternating Current): An electric current that reverses direction periodically. It is the type of current delivered to homes and businesses.

Array: A group of photovoltaic (PV) modules connected together to generate electricity.

Balance of System (BOS): Components of a PV system other than the solar panels and inverter, including wiring, mounting structures, batteries, charge controllers, and safety devices.

Charge Controller: A device that regulates the voltage and current coming from the solar panels to the batteries, preventing overcharging and deep discharge.

Circuit: A complete, closed path through which electric current can flow.

Conductor: A material that allows the flow of electric current; copper and aluminum are common examples.

Circuit Breaker: A safety device that automatically interrupts the electrical flow in a circuit when it detects an overload or short circuit.

Connector: A device used to join electrical circuits or components together.

Current (I): The flow of electric charge, measured in amperes (A).

DC (Direct Current): Electric current that flows in one direction only, produced by solar panels.

Grid-Tied System: A PV system connected to the utility grid, allowing the transfer of excess energy back to the grid.

Ground Mount: A type of PV system installation where solar panels are mounted on a structure built at ground level.

Heat Sink: A component used to dissipate heat away from electrical devices such as inverters to prevent overheating.

Insulation: Material used to prevent the flow of electricity and protect wires and users from electrical shock.

Installation: The process of setting up equipment or systems for operational use.

Inverter: A device that converts DC electricity generated by solar panels into AC electricity used by most appliances and systems.

Kilowatt (kW): A unit of power equal to 1,000 watts, used to measure the output of solar panel systems.

Kilowatt-Hour (kWh): A unit of energy representing the power consumption of 1 kW for one hour; commonly used to measure electricity usage.

Load: The electrical power consumed by a device or system.

Lithium-ion Battery: A type of rechargeable battery commonly used in portable electronics.

Module: A single unit in a PV array made up of multiple interconnected solar cells.

Mounting System: The structure used to secure solar panels in place, which can be roof-mounted, ground-mounted, or tracking systems.

MPTT (Maximum Power Point Tracking): A technique used in charge controllers and inverters to maximize the power output from solar panels by finding the optimal power point under changing sunlight conditions.

Multimeter: An instrument that can measure voltage, current, and resistance in an electrical circuit.

Net Metering: A system that allows consumers with solar panels to send excess electricity back to the grid and receive credit on their electricity bills.

Photovoltaic (PV) System: A system that converts sunlight into electrical energy through solar panels.

PV Array: The configuration of interconnected solar panels that generate electricity for a PV system.

Protection Device: Safety equipment like circuit breakers, fuses, and surge protectors that safeguard the system against electrical faults.

Power Output: The amount of electrical power generated by a PV system, measured in watts (W) or kilowatts (kW).

Rack System: The structure or framework used to support and position PV panels, often adjustable for optimal sunlight exposure.

Renewable Energy: Energy sourced from natural processes that are continuously replenished, such as sunlight and wind.

Resistance (R): A measure of the opposition to current flow in a circuit.

Rooftop Installation: The installation of solar panels on the roof of a building or structure.

Shading: Any obstruction that prevents direct sunlight from reaching the solar panels, which can reduce system efficiency.

Short Circuit: A fault that occurs when there is a direct path for current to flow between two points, bypassing the intended path.

Schematic Diagram: A simplified representation of an electrical circuit showing the connections between components.

Socket: A device that allows for the connection of electrical plugs.

Switch: A device used to open or close an electrical circuit, controlling the flow of current.

Safety Protocols: Procedures and guidelines established to protect people and equipment from electrical hazards.

Troubleshooting: The process of diagnosing and resolving issues within an electrical or electronic system.

Voltage (V): The electrical potential difference between two points, measured in volts.

Watt (W): The unit of power, equivalent to one joule per second.

Wire Stripper: A tool used to remove the insulation from wires for electrical connections.

Zoning Regulations: Local laws and rules that govern the installation of PV systems, ensuring they meet safety and land use standards.

TOOLS, MATERIALS, AND EQUIPMENT

TOOLS	MATERIALS	EQUIPMENT
Spirit level	Junction box PVC	Electric drill
Hack saw	#16 G.I wire	Portable grinder
Pipe cutter	Whiteboard 4 x 8 x $\frac{3}{4}$	Gun tucker
Pipe reamer	Whiteboard 4 x 4 x $\frac{3}{4}$ with movable stand	Fire Alarm System (with smoke detector, heat detector, siren/buzzer/bell, strobe light, manual call point)
Pipe threader	Whiteboard marker, assorted color	CCTV System
Pipe bender	Push pins	Labelling machine
Bolt cutter	Pencil sharpener	Battery Cell tester
Ball hammer	Utility box	PV modules
Electrician pliers	Connectors PVC, $\frac{1}{2}$	Solar Charge Controller

Side cutter	Connectors PVC, $\frac{3}{4}$	Battery
Screwdrivers set	PVC square box 4 x 4	Battery Box
Box wrench	Flexible conduit $\frac{1}{2}$ ", $\frac{3}{4}$	Support Structure - single module
Wire splicer	PVC Conduit $\frac{1}{2}$, $\frac{3}{4}$	Inverter (full sine) 200 VA
Wire stripper	RSC/IMC/EMT	Inverter (modified) 500 VA
Electrician knife	Entrance cap	Variable Power Supply
Tools holster	Locknut & bushing	Workshop table
Push-pull 0-5 meters	Ground fault current Interrupting device	Fire extinguisher KGS ABC
Claw hammer	3/16" x 1" Metal Screw	LCD Projector
Prick punch	Conduit strap/clamp	Laptop
Safety belt	Wiring boards 3/4ft x 8ft x 8ft	Workshop table
Heat gun 1200 watts	Floor outlet	Fire extinguisher KGS ABC
Heavy-duty soldering iron	Working gloves	Relays (14-pin, 220V coil)
Soldering iron (30-60watts)	Safety shoes	Magnetic contactor w/ 2NO,2NC auxiliary contacts (220V coil)
Desoldering tools	Hard hat	
Multi-tester (analog/digital)	Safety goggles	
Earth resistance tester	Wire AWG#12, 3.5mm ²	
Insulation resistance tester	Wire AWG #14, 2.0mm ²	
Allen wrench/key	Wire AWG #18, single-core (stranded)	
Flat file smooth 8"	Wood screw $\frac{1}{2}$ " x 8	
	Receptacle surface type	
	Receptacle flush type	
	CFL 11 W 12Vdc	
	Incandescent bulb 100w 220VAC	
	Convenient outlet 2-gang with plate and cover	

REFERENCE:

- Technical Education and Skills Development Authority (TESDA). Training Regulations for Electrical Installation and Maintenance NC II (Amended). Promulgated Dec. 16, 2015.

<https://tesda.gov.ph/Downloadables/TR-Electrical%20Installation%20and%20Maintenance%20NC%20II.pdf>

- Technical Education and Skills Development Authority (TESDA). Training Regulations for PV Systems Installation NC II.

<https://e-tesda.gov.ph/course/index.php?categoryid=1287>