**Solar Electric Technician Training**

**Module 4: Site selection for solar PV systems**

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| **Objectives:** By the end of this session, learners will be able to:   * Discuss factors for site assessment including roof orientation, ground condition, shading, optimum direction, air circulation, and wiring requirements, etc. for different types of systems. * Use forms to assess the site condition to select suitable location for PV array, inverter, battery bank, water pump, pump controller and balance of system (BoS) for different types of systems. * Prepare and plan the installation at site by referring to the mounting structure drawings and adhering to the specifications and manuals for inverters, battery banks, water pumps, pump controllers, and BoS, considering the drawings (engineering, single line, etc.) and site conditions. * Finalize the cable route plan and power evacuation location. | **Instructor:** *[Name]* |
| **Session duration:**   * 9 hours (Theory) * 33 hours (Practical) |

| **Trainers’ activities** | **Learners’ activities** | **Teaching aids** | **Time** |
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| 1. **Discuss factors for site assessment including roof orientation, ground condition, shading, optimum direction, air circulation, and wiring requirements, etc. for different types of systems.** | | | **480’** |
| **Session kick-off:** Start the session with the brief overview of objectives and agenda  Ask participants the following questions to simulate discussion:   * What is site assessment? * What is the role of a technician during the site assessment? * What is the Importance of site assessment? * What tools are required to conduct a site assessment. | Participants in the discussion. | * Meta-cards   Pictures | 40’ |
| Give an illustrative talk on **factors for site assessment covering:**   * **Site accessibility** * Road condition (black topped or off-road) * Nearest landmark area * Access of telecommunication and internet * **Panel installation site condition** * Type of mounting location – roof or ground * If roof mount: * Number of roofs * Type of roofs (RCC, tiles, GI sheets, etc.) * Accessibility to roof * Load bearing condition * Roof orientation * Roof tilt angle * Roof age * If ground mount: * Ground material (RCC, soil, etc.) * Ground condition (levelled, slope, etc.) * Any vegetation * **Shading/Shadow** * Potential source of near and far shading * Shadow from vegetation and trees * Shadow from other buildings * Shadow from natural landscape (hilly area) * **Pump installation** * Type of water source * GPS location of water source * Risks at pump intake * Borewell type and size * Distance between intake and pump house * Distance between intake and distribution * Transmission and distribution pipe layout (underground or overhead) * **Other factors:** * Are there any flammable materials nearby (ground) or inside building (roof)? * Wind velocity * Space availability for inverter, batteries, pump controller * Cable route scenario (overhead or underground) | Participants in the discussion. | * Pre-feasibility / Detailed feasibility survey form. * Required survey tools: measurement tape, compass, sun-path app, multi meter, etc. | 40’  100’  100’  100’  100’ |
| 1. **Use forms to assess the site condition to select suitable location for PV array, inverter, battery bank, water pump, pump controller and balance of system (BoS) for different types of systems.** | | | **360’** |
| Using the survey form, perform the site assessment for (at least two technologies)   * Solar rooftop system (V1) * Solar water pumping system (V2) * Solar mini-grid system (V3) | * Using the survey form, participants will perform the assessment. | * Pre-feasibility / Detailed feasibility survey form V1, V2 & V3 | 100’ for each |
| **Debriefing:**   * Discussion on the site assessment performed by trainers. | * Participants in the discussion. | * Meta-cards | 60’ |
| 1. **Prepare and plan the installation site by consulting the mounting structure drawings and adhering to the specifications and manuals for inverters, battery banks, water pumps, pump controllers, and BoS, considering the drawings (engineering, single line, etc.) and site conditions.** | | | **1440’** |
| Discussion:   * What are the roles of technician before the installation? * Verify the survey report. * Consult with the concerned person. * List of the installation tools. | * Participants in the discussion. | * Meta-cards * Review of survey report * Assignment (E1) | 30’ |
| 1. **Mounting structure** | | | |
| * Verify the location of mounting structure w.r.t report. * GPS location, * Potential shadings,   Site clearance | * Review and verify the location | * Survey report | 15’ |
| * Discuss and perform following: * Read the mounting structure drawing. * Identify the structure parts. * Verify if the inclined angle is as per report * Recalculate/ verify the inter-row spacing. * List the installation accessories and tools required. * Pre-plan the mounting location (measure the site area as per report and mark). | * Read structure drawing. * Identify the necessary tools required during the installation. * Measure the area for installation. | * Assignment (E2) | 150’ |
| 1. **PV system wiring diagram and SLD** | | | |
| * Verify the PV modules w.r.t report. | * Review report. | * Survey report | 15’ |
| * Discuss and perform following: * Specification of PV modules and BOS. * Review the wiring diagram of PV system. * Review the single line diagram (SLD). | * Read specification of PV module. * Read the wiring diagram of PV array * Identify the necessary tools required during the installation. | * Assignment (E3) | 150’ |
| 1. **Inverter manual** | | | |
| * Verify the inverter w.r.t report. | * Review report. | * Survey report | 15’ |
| * Discuss and perform following: * Read the specification of inverter. * Read following from inverter manual: * Safety parameters, * Mounting parameter, * Operating conditions such as voltage, current, temperature, etc. * Installation process, * Wire connection, * Ventilation requirement, * Compliance | * Read inverter manual. | * Assignment (E4) | 150’ |
| 1. **Battery bank installation requirement** | | | |
| * Verify the batteries w.r.t report. | * Review report. | * Survey report | 15’ |
| * Discuss and perform following: * Read the specification of battery. * Safety parameters * Operating conditions such as voltage, current, temperature, etc. * Installation process, * Wire connection, * Ventilation requirement, * Maintenance * List the necessary tools for installation. * Verify if the allocated location is flammable or not. | * Read battery specification. | * Assignment (E5) | 150’ |
| 1. **Water pump** |  |  |  |
| * Verify the water pump w.r.t report. | * Review report. | * Survey report | 15’ |
| * Discuss and perform following: * Read the specification of water pump. * Safety parameters, * Mounting parameter, * Operating conditions such as voltage, current, temperature, etc. * Installation process, * Wire connection, * Maintenance * List the necessary tools for installation. * Verify the water source and water recharge condition. | * Read water pump specification. | * Assignment (E6) | 150’ |
| 1. **Pump controller** |  |  |  |
| * Verify the pump controller w.r.t report. | * Review report. | * Survey report | 15’ |
| * Discuss and perform following: * Read the specification and manual of pump controller. * Safety parameters, * Mounting parameter, * Operating conditions such as voltage, current, temperature, etc. * Installation process, * Wire connection, * Maintenance * List the necessary tools for installation. | * Read pump controller specification and manual. | * Assignment (E7) | 150’ |
| 1. **Balance of System (BoS)** |  |  |  |
| * Verify the BoS items w.r.t report. | * Review report. | * Survey report | 15’ |
| * Discuss and perform following: * Combiner boxes * Verify the location of combiner boxes installation. * Verify the size and type. * List the accessories required for installation. * Wires and cables * Verify the cable sizes * List the accessories required for installation. * Protection devices * Verify the protection devices – Earthing, LA, fuse, MCBs, MCCBs, etc. * Verify the location for installation. * Wire connection * Installation accessories * Verify the installation accessories like cable shoes, MC4 connectors, cable tray, saddles, labelling, nut and bolts, etc. |  | * Assignment (E8) | 150’ |
| * Debriefing the plan of installation. | * Participants in the discussion. |  | 15’ |
| 1. **Finalize the cable route plan and power evacuation location.** | | | **240’** |
| * Ask question:   After the planning, before the installation, how do you finalize the overall installation plan? | * Participants in the discussion. |  | 30’ |
| Discuss the following:   * Finalize the system component location and their cable route plan: * Solar PV modules, * Inverter, * Battery, * Water pump, * Pump controller, * Combiner boxes, * Protection devices. | * Participants in the discussion. |  | 120’ |
| Discuss and perform the following:   * Finalize the cable route plan between: * PV interconnection, * PV to inverter, * Battery interconnection, * Inverter to battery, * Inverter to main combiner box, * Pump and pump controller, * PV to pump controller, * Protection devices cabling, * Discuss the layout of cable route * Underground or overhead * Conduits used | * Participants in the discussion. | * Assignment (E9) | 90’ |
| **Total time** | | | **2520’** |