

Model Curriculum

Solar PV Installer - Electrical

SECTOR: GREEN JOBS
SUB-SECTOR: RENEWABLE ENERGY
OCCUPATION: INSTALLATION AND COMMISSION
REF ID: SGJ/Q0102, V1.0
NSQF LEVEL: 4



Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

SKILL COUNCIL FOR GREEN JOBS

for the

MODEL CURRICULUM

Complying to National Occupational Standards of
Job Role/Qualification Pack: '**Solar PV Installer - Electrical**' QP No. '**SGJ/Q 0102 NSQF Level 4**'

Date of Issuance: December 7th, 2015

Valid up to: October 1st, 2018

* Valid up to the next review date of the Qualification Pack



Authorised Signatory
(Skill Council for Green Jobs)

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Solar PV Installer- Electrical

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a "Solar PV Installer -Electrical", in the "Green Jobs" Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	Solar PV Installer – Electrical		
Qualification Pack Name & Reference ID. ID	SGJ/Q0102, v1.0		
Version No.	1.0	Version Update Date	31 st December 2015
Pre-requisites to Training	ITI / Diploma (Electrical, Electronics)		
Training Outcomes	<p>After completing this programme, participants will be able to:</p> <ul style="list-style-type: none"> • Carry out the site survey for installation of Solar PV system • Identify and Use the Tools & tackles used for Solar PV system installation • Install the Electrical components of a Solar PV system • Test and Commission Solar PV system • Maintain personal Health & Safety at project site 		

This course encompasses 4 out of 4 National Occupational Standards (NOS) of “Solar PV Installer – Electrical” Qualification Pack issued by “Skill Council for Green Jobs”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	Introduction to Solar PV Installer – Electrical Course Theory Duration (hh:mm) 03:00 Practical Duration (hh:mm) 03:00 Corresponding NOS Code SGJ/No101	<ul style="list-style-type: none"> • Demonstrate general Discipline in the class room and during the training program; • Understand the role of Solar PV Installer and job opportunities; • Understand the advantages of doing this course; • Acquire basic skills of communication; • Acquire basic reading capabilities to enable reading of signs, notices and/or cautions at site. 	
2	Basics of Solar energy and Electrical concepts. Theory Duration (hh:mm) 06:00 Practical Duration (hh:mm) 06:00 Corresponding NOS Code SGJ/No101	<ul style="list-style-type: none"> • Understand Ohm’s Law; • Understand the basics of electricity and electrical concepts; • Perform simple calculations to derive power and energy • Explain and understand DNI, GHI and Diffused Irradiance & Irradiation; • Understand the movement of the sun and its effect on the performance of the plant; • Understand Terminology used in the Solar Industry; 	Pyranometer, Multimeter, Clamp meter,
3	Basics of Solar Photovoltaic systems and its components. Theory Duration (hh:mm) 14:00 Practical Duration (hh:mm) 20:00 Corresponding NOS Code SGJ/No101	<ul style="list-style-type: none"> • Identify the different components of a Solar PV system and its basic operation; • Identify and understand the working of different types of Solar PV systems • Understand and acquire know-how of different Types, sizes and specifications of , Modules, Solar Inverters, Charge Controllers, Cables, Conduits, Junction Boxes, Solar Batteries and allied accessories. • Read and Interpret the manufacturing data specification sheets of different Types, sizes and specifications of , Modules, Solar Inverters, Charge Controllers, Cables, Conduits, Junction Boxes, Solar Batteries and allied accessories 	Pyranometer, Multimeter, Clamp meter, 1 kWp Solar PV system with 2 number of solar batteries

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"> Understand and acquire know-how of different Types, sizes and specifications of foundations/footings; Select the right footing/foundation as per site location including suitability of roof condition or suitability of soil 	
4	<p>Identification and Use of different tools and tackles used for installation of solar PV system</p> <p>Theory Duration (hh:mm) 03:00</p> <p>Practical Duration (hh:mm) 06:00</p> <p>Corresponding NOS Code SGJ/Q0104</p>	<ul style="list-style-type: none"> Identify and acquire the know-how of the different tools & tackles used for specific purpose in an installation of Solar PV system 	<p>Tool kit, Double ended flat spanner, Double ended ring spanner, Combination pliers, Side cutting pliers, Nose pliers, Hack saw ,frame with blade, Screw driver, Water level Measuring tape, Centre punch, Standard wire gauge, Vanier caliper, Line Dori, Chisel, Drill m/c, Plumb bob, Sprit level, Flat file, Round file, Triangle file, Hand saw, PVC mallet, Ball pin, hammer, Safety helmet, Safety souse, Safety belt, Nose mask, Safety goggles, Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
5	Site Survey for Installation of Solar PV System . Theory Duration (hh:mm) 06:00 Practical Duration (hh:mm) 17:00 Corresponding NOS Code SGJ/No101	<ul style="list-style-type: none"> Understand how to observe Sun path diagram and shading analysis; Understand and assess the site conditions for safe installation of Solar PV system; Identify the load to be connected to the Solar PV system; Prepare load profile Engage with customers for any specific requirement and budget constraints; Calculate size of the system with basic mathematical tools; 	Tool kit, Measuring tape, wire gauge, Line Dori Water testing instrument (TDS meter),
6	Installation of Electrical Components of Solar PV Systems. Theory Duration (hh:mm) 18:00 Practical Duration (hh:mm) 46:00 Corresponding NOS Code SGJ/No104	<ul style="list-style-type: none"> Read and Interpret the Single Line Diagram, Layout Diagrams. Understand the DO's and Don'ts of material handling; Read and interpret the Bill of Material to verify with the delivery of components on-site. Understand and acquire know-how of installing the electrical components including inverter, batteries, junction boxes, energy meters and other electrical components Identify and acquire know-how of installation of cables and conduits; Understand Do's and Don'ts of DC wiring; Identify and understand use of Tools & tackles used for cable and conduit installation Understand Different types of Earthing and its installation; Understand and identify significance and types of earth faults as per standards 	1 kW Solar PV system and tool kit
7	Test and Commission Solar PV system Theory Duration (hh:mm) 07:00 Practical Duration (hh:mm) 13:00 Corresponding NOS Code	<ul style="list-style-type: none"> Describe and conduct the testing of all the solar components of the Solar PV system including fault finding and analysis including continuity checks, polarity check and other commissioning activities; Understand Regulations & Standards for interconnection; Describe the Commissioning process for the Solar PV System 	Tool kit, 1kWp Solar PV system, Side cutting pliers, Nose pliers, Wire stripper, Electrician knife, Hand crimping tools, Cable cutter , Screw driver, Water level Measuring tape, Centre punch,

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	SGJ/No105		Standard wire gauge, Vanier calliper, Line Dori, Fuse puller, Safety helmet, Safety shoe, Safety belt, Nose mask, Safety goggles, Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Clamp meter, MULTIMETER, Megger, Earth tester, Earthing Rod, Soldering Iron & Flux, Phase ,Sequence Meter, Safety Gloves, Pyranometer.
8	Maintain Personal Health & Safety at project site Theory Duration (hh:mm) 03:00 Practical Duration (hh:mm) 09:00 Corresponding NOS Code SGJ/No106	<ul style="list-style-type: none"> Identify the requirements for safe work area; Administer first aid; Identify the personal protective equipment used for the specific purpose; Identify the hazards associated with photovoltaic installations; Identify work safety procedures and instructions for working at height; Understand Occupational health & Safety standards and regulations for installation of Solar PV system 	Safety helmet, Safety souse, Safety belt, , Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves
9	Communication & Soft Skills Theory Duration (hh:mm) 05:00 Practical Duration (hh:mm) 15:00	<ul style="list-style-type: none"> Oral/spoken communication skill & testing – voice and accent, voice clarity Development Etiquette and manners Study of different pictorial expression of non-verbal communication and its analysis Barriers to Communication- Int. & Ext Barriers like Intrinsic Motivation, Perception, Language, Fear Power of speech etc. 	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Corresponding NOS Code SGJ/No101, SGJ/No104, SGJ/No105, SGJ/No106	<ul style="list-style-type: none"> Importance of Listening, Good and bad listening Non-Verbal Communication – its importance and Nuances like Facial Expression, Posture, Gesture, eye contact, Appearance (Dress Code), etc. Handling Interview Situations 	
	Total Duration Theory Duration 65:00 Practical Duration 135:00	Unique Equipment Required: Tool kit, Double ended flat spanner, Double ended ring spanner, Combination pliers, Side cutting pliers, Nose pliers, Wire stripper, Electrician knife, Hack saw frame with blade, Hand crimping tools, Cable cutter, Screw driver, Water level, Measuring tape, Centre punch Standard wire gauge, Vanier calliper, Line Dori, Chisel, Drill m/c, Plumb bob, Sprit level, Flat file, Round file, Triangle file, Hand saw, PVC mallet, Ball pin hammer, Fuse puller, Safety helmet, Safety souse, Safety belt, Nose mask, Safety goggles, Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Clamp meter, MULTIMETER, Megger, Earth tester, Water testing instrument (TDS meter), Earthing Rod, Soldering Iron & Flux, Phase Sequence Meter, Safety Gloves, Pyranometer	

Grand Total Course Duration: **200Hours, 0 Minutes**

(This syllabus/ curriculum has been approved by [Skill Council for Green Jobs](#))

Trainer Prerequisites for Job role: "Solar PV Installer - Electrical" mapped to Qualification Pack: "SGJ/Qo102, v1.0"

Sr. No.	Area	Details
1	Description	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack "SGJ/Qo102, Version 1.0".
2	Personal Attributes	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in the mentioned field.
3	Minimum Educational Qualifications	ITI /Diploma (Electrical, Electronics) or B.Tech (Civil / Electrical / Electronics / Electrical and Electronics Eng.) or MSc Physics or The education qualification can be relaxed in case of extraordinary relevant field experience.
4a	Domain Certification	Certified for Job Role: "Solar PV Installer- Electrical" mapped to QP: "SGJ/Qo102, Version 1.0". Minimum accepted score as per respective SSC guidelines. Minimum accepted score as per SCGJ is 80%.
4b	Platform Certification	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "SSC/1402". Minimum accepted score as per SCGJ is 70%.
5	Experience	Minimum 3 years of relevant industry experience for ITI /Diploma (Electrical, Electronics) or Minimum 2 years of relevant industry experience for B.Tech (Civil / Electrical / Electronics / Electrical and Electronics Engineering)

Annexure: Assessment Criteria

Assessment Criteria for Solar PV Installer – Electrical	
Job Role	Solar PV Installer- Electrical
Qualification Pack	SGJ/Qo102, Version 1.0
Sector Skill Council	Green Jobs

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for Qualification Pack has been created based on the NOSs and performance criteria by SCGJ. Each Performance Criteria (PC) has been assigned marks proportional to its importance within NOS and weightages have also been given among the NOSs accordingly. SCGJ has laid down the proportion of marks for Skills, Theory/Knowledge and Behaviour / Attitudes for each PC.
2	The assessment of the theory/knowledge will be based on written test/viva-voce or both while skill test shall be hands on practical. Behaviour and attitude will be assessed while performing the task.
3	The assessment shall be done as per the assessment sheets devised by SCGJ and accordingly the assessment agencies in consultation with SCGJ will create unique question papers for theory/knowledge and attitude for each candidate at each SCGJ accredited testing centres (as per assessment criteria below)
4	The assessment agencies will conduct the assessment as per the guidelines given by SCGJ having unique evaluations for skill practical for every student at each SCGJ accredited testing centre based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% in the overall assessment.
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome (NOS)	Assessment Criteria	Total Mark	Out Of	Marks Allocation	
				Theory	Skills Practical
SGJ/N0101 Site Survey for Installation of Solar PV System	PC1. Understand the location of Installation and optimize the route plan.	30	4	1	3
	PC2. Asses the site level pre-requisites for solar panel installation		3	2	1
	PC3. Check for any shading obstacles.		2	1	1
	PC4. Decide the type of mounting to be constructed.		2	2	
	PC5. Inform the customer for any civil construction to be undertaken for installing the panels		2	1	1
	PC6. Prepare a site map of the location where installation has to be carried out.		5	2	3
	PC7. Assess the load to be run on Solar Power Plant		5	2	3
	PC8. Prepare a load profile		3	3	

Assessable Outcome (NOS)	Assessment Criteria	Total Mark	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC9. Document the site survey variables and complete the checklist/site survey form		4	2	2
	NOS Total Marks	TOTAL	30	16	14
SGJ/N0104 Install Electrical Components of Solar PV System	PC1. Implement the site safety plan and Maintain clear work area.	90	2	1	1
	PC2. Clarify the maximum working voltage		1	1	
	PC3. Select required Personal Protective Equipment (PPE)		2	1	1
	PC4. Measure current and voltage on equipment before proceeding with work		2	1	1
	PC5. Inspect and demonstrate the use of electrical installation toolkit		4	1	3
	PC6. Demonstrate situational awareness		3	1	2
	PC7. Select the location of DC combiner box		2	1	1
	PC8. Install DC combiner box along with disconnect protections		4	1	3
	PC9. Install DC energy meters		2	1	1
	PC10. Confirm battery bank location and Install batteries.		2	1	1
	PC11. Prepare battery terminals and Install battery interconnection cables.		2	1	1
	PC12. Terminate fine stranded cables.		2	1	1
	PC13. Test final assembled battery polarity and voltage.		2	1	1
	PC14. Install charge controller (if required)		2	1	1
	PC15. Install inverter		4	1	3
	PC16. Install utility required disconnects		3	1	2
	PC17. Install AC combiner box		2	1	1
	PC18. Connect the solar Power Plant to the Distribution box or Transformer.		4	1	3
	PC19. Proper labelling of the components		2	1	1
	PC20. Prepare conduit and cable routing plan		4	2	2
	PC21. Select the correct cable type, color, and gauge.		4	2	2
	PC22. Ensure that the conduits are properly supported and secured		2	1	1

Assessable Outcome (NOS)	Assessment Criteria	Total Mark	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC23. Install the cables for modules, inverter and other components		4	1	3
	PC24. Terminate cables.		3	1	2
	PC25. Check cables for continuity		2	1	1
	PC26. Proper labelling of conduits and cables		2	1	1
	PC27. Locate underground hazards, if any		2	1	1
	PC28. Get the grounding Power Plant installed for modules/mounting Power Plant and inverters		4	2	2
	PC29. Get the Bonding done for all electrical equipment and apply anti – oxidant material		4	2	2
	PC30. Confirm and install battery bank enclosure/racks.		4	2	2
	PC31. Install battery spill containment (if required).		2	1	1
	PC32. Install batteries and Prepare battery terminals (e.g., clean).		4	2	2
	PC33. Install battery interconnection cables and apply anti-oxidant material		2	1	1
	NOS Total Marks	TOTAL	90	39	51
SGJ/N0105 Test and Commission Solar PV system.	PC1. Perform visual inspection.	50	4	2	2
	PC2. Inspect mechanical civil and electrical installation components.		4	2	2
	PC3. Verify Power Plant grounding and measure insulation resistance		4	1	3
	PC4. Check continuity of the Power Plant and Verify polarity.		4	2	2
	PC5. Measure DC voltages and currents for each string and array for proper operation of the system		4	2	2
	PC6. Verify inverter operation including anti-islanding performance and measure AC system values.		6	3	3
	PC7. Verify calibration of Data Acquisition System.		1	1	
	PC8. Verify workmanship and demonstrate proficiency in using tools		6	2	4

Assessable Outcome (NOS)	Assessment Criteria	Total Mark	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC9. Preparation of the Inspection report and take appropriate action		3	2	1
	PC10. Verify labelling of Solar PV system.		2	1	1
	PC11. Initiate start up procedures as per manufacturer instructions and record energy meter reading at start up		6	3	3
	PC12. Measure and record voltage of energy storage system		2	1	1
	PC13. Record and repair any anomalous conditions.		2	1	1
	PC14. Document design changes, if any		2	1	1
	NOS Total Marks	TOTAL	50	24	26
SGJ/N0106 Maintain work Safety of Solar PV System	PC1. Identify corporate policies required for workplace safety.	50	2	1	1
	PC2. Identify requirements for safe work area and create a safe work environment.		3	2	1
	PC3. Identify contact person when workplace safety policies are violated.		1	1	0
	PC4. Provide information about incident/violation.		1	1	
	PC5. Identify the location of First Aid materials and administer first aid		2	1	1
	PC6. Identify the personal protection equipment required for specific locations on-site		3	2	1
	PC7. Identify expiry dates and wear & tear issues of specified equipment.		2	1	1
	PC8. Demonstrate safe and accepted practices for personal protection.		3	2	1
	PC9. Identify environmental hazards associated with photovoltaic installations.		2	1	1
	PC10. Identify electrical hazards.		4	2	2
	PC11. Identify personal safety hazards or work site hazards and Mitigate hazards.		4	2	2
	PC12. Select tools, equipment and testing devices needed to carry out the work.		4	2	2
	PC13. Demonstrate safe and proper use of required tools and equipment.		4	2	2

Assessable Outcome (NOS)	Assessment Criteria	Total Mark	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC14. Check access from ground to work area to ensure it is safe and in accordance with requirements.		2	1	1
	PC15. Reassess risk control measures, as required, in accordance with changed work practices and/or site conditions and undertake alterations.		2	2	0
	PC16. Inspect/install fall protection and perimeter protection equipment ensuring adequacy for work and conformance to regulatory requirements.		4	2	2
	PC17. Identify approved methods of moving tools and equipment to work area and minimize potential hazards associated with tools at heights		2	1	1
	PC18. Select and install appropriate signs and barricades		2	1	1
	PC19. Place tools and materials to eliminate or minimize the risk of items being knocked down.		1	1	
	PC20. Dismantle safety Power Plant in accordance with sequence and remove from worksite to clear work area.		2	1	1
	NOS Total Marks	TOTAL	50	29	21
	QP Total Marks	TOTAL	220		