Model Curriculum

Solar PV O&M Engineer

SECTOR:	**GREEN JOBS**
SUB-SECTOR:	**RENEWABLE ENERGY**
OCCUPATION:	**Operation and Maintenance**
REF ID:	**SGJ/Q0117, V1.0**
NSQF LEVEL:	**5**

Skill India

SCGJ SKILL COUNCIL FOR GREEN JOBS

N·S·D·C National Skill Development Corporation
Transforming the skill landscape

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 O&M Engineer**' QP No. '**SGJ/Q 0117 NSQF Level 5**'

Date of Issuance: **October 16th, 2017**

Valid up to: **September 30th, 2019**

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

Authorised Signatory
(Skill Council for Green Jobs)

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Solar PV O&M Engineer

CURRICULUM / SYLLABUS

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

Program Name	**Solar PV O&M Engineer**		
Qualification Pack Name & Reference ID.	SGJ/Q0117, v1.0		
Version No.	1.0	**Version Update Date**	01th Aug 2017
Pre-requisites to Training	Diploma (Electrical/Electronics/ Civil/ Mechanical) or Pre-final engineering and technology candidate with 3 years of formal engineering education		
Training Outcomes	**After completing this programme, participants will be able to:** • **Carry out operation of Solar PV power plant** • **Carry out electrical maintenance of Solar PV power plant** • **Carry out civil / mechanical maintenance of Solar PV power plant** • **Maintain personal health & safety at project site** • **Work effectively with others**		

This course encompasses 5 out of 5 National Occupational Standards (NOS) of "Solar PV O&M Engineer" Qualification Pack issued by "Skill Council for Green Jobs".

S. No	Module	Key Learning Outcomes	Equipment Required
1	**Introduction to Solar PV Sector in India** **Theory Duration** (hh:mm) 12:00 **Practical Duration** (hh:mm) 12:00 **Introduction Module**	• overview of solar PV technology • overview of ground mount solar sector in India • understand the various market research reports and industrial magazines present in the market • type of ground mount PV Power Plants and working principles • overview of Rooftop Solar Sector in India • type of Rooftop Solar PV Power Plants and working principles • overview of off grid Solar Sector in India • type of off grid Solar PV Power devices and their working principles • basics of electrical concepts like voltage, current, power, energy, etc. • solar energy and power sector landscape in the country • benefits of solar energy over conventional sources of energy • typical specifications, functioning, operating principle, maintenance requirements, handling procedures and warranties of different types of solar PV plant components like PV modules, inverters, cables, junction boxes, monitoring system and other components • understand various financial institutions and banks involved in solar power projects as well as their terms & conditions associated with loans	
2	**Carry out operations of Solar PV Power Plant** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 26:00 **Corresponding NOS Code** SGJ/N0139	• check the voltage, current and power at different levels in the plant • monitor the generation of power from the plant on hourly, daily, monthly, yearly basis • ensure proper storage and retrieval of data from the monitoring system • compute the metrics like performance ratio, capacity utilization factor etc. • compare and analyze the actual generation with the theoretical simulation data and report any deviations • identify the fault/s in the solar PV power plant and the cause of the identified fault/s • take necessary corrective actions to restore the plant performance	1 kWp Solar PV power plant, Solar PV Operation & Maintenance toolkit, Site visit for practical learning

3	**Carry out electrical maintenance of Solar PV Power Plant** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 26:00 **Corresponding NOS Code** SGJ/N0140	• prepare the preventive maintenance schedule in consultation with the senior • ensure proper functioning of the earthing and lightening protection system as per documented procedure • ensure proper functioning of all electrical connections in a solar PV power plant up to the inverter input by maintaining it as per schedule • ensure proper maintenance by adherence to the schedule for sequential standard troubleshooting activity of all individual electrical components of the solar PV power plant including modules, inverters, etc. taking into account all safety procedures and standards • analyze thermography data to identify weak and loose connections in the solar PV power plant or defect in the module/cell • ensure proper maintenance of the monitoring system • analyze the causes of faults in the solar PV power plant in case of interruption or drop in power generation and ensure appropriate corrective action is taken, considering all safety procedures and standards • analyze the strings identified as faulty by the technician/s to detect/identify the root cause of the problem • ensure cleaning of work areas by technicians post completion of the maintenance activity • ensure complete documentation of the job completion forms with signature of the customer or supervisor as per relevant industry standards	Solar PV Operation & Maintenance toolkit, Site visit for practical learning
4.	**Carry out civil / mechanical maintenance of Solar PV Power Plant** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 26:00 **Corresponding NOS Code** SGJ/N0141	• ensure structural integrity of the civil foundations and module mounting structures including clamping arrangements, tracking system etc. by maintaining them as per schedule and taking into account all safety procedures and standards • ensure proper mounting of junction boxes/combiner boxes • ensure there is no shadowing of modules during the day by periodically removing all obstacles including vegetation, etc. • ensure proper cleaning of solar modules as per schedule	Solar PV Operation & Maintenance toolkit, Site visit for practical learning

		• ensure uninterrupted water supply for cleaning of solar modules • ensure proper maintenance of the drainage system and inverter/control room is carried out • ensure rectification of the internal roads and pathways between the arrays, as and when required, and prevent any water logging • ensure rectification of any loose clamps, nuts and bolts, as and when required • ensure proper functioning of the tracking system, as and when required • ensure cleaning of work areas by technicians post completion of the maintenance activity • ensure complete documentation of the job completion forms with signature of the customer or supervisor as per relevant industry standards	
5.	**Maintain Personal Health & Safety at project site** **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 06:00 **Corresponding NOS Code** SGJ/N0106	• 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 • Personal Protective Equipment's and their applications • safety measures while working at height	Safety helmet, Safety souse, Safety belt, , Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves
6.	**Work effectively with others** **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code** SGJ/N0120	• accurately pass on information to the authorized persons who require it and within agreed timescale and confirm its receipt • assist others in performing tasks in a positive manner where required and possible • consult and assist others to maximize effectiveness and efficiency in carrying out tasks • display appropriate communication etiquette while working • display active listening skills while interacting with others at work • demonstrate responsible and disciplined behaviors at the workplace	

		• escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict • identify the need for common grounds with clients, team members, etc. and negotiate in an effective manner to achieve the same • consider and respect the opinions, creativity, values, beliefs and perspectives of others • ensure collaboration and group participation to achieve common goals • promote a friendly, co-operative environment that is conducive to employee's sense of belonging • facilitate an understanding and appreciation of the differences among team members	
	Theory Duration (hh:mm) 84:00 **Practical Duration** (hh:mm) 116:00	1 kWp Solar PV power plant, Solar PV Operation & Maintenance toolkit, Safety helmet, Safety souse, Safety belt, Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves, Site visit for practical learning	

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

*(This syllabus/ curriculum has been approved by **Skill Council for Green Jobs)***

Trainer Prerequisites for Job role: "Solar PV OM Engineer" mapped to Qualification Pack: "SGJ/Q0117, 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/Q0117, 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**	Any Graduate.
4a	**Domain Certification**	Certified for Job Role: "Solar PV OM Engineer" mapped to QP: "SGJ/Q01117", Version 1.0". Minimum accepted score as per respective as per SCGJ guidelines is 80%.
4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "MEP/Q0102" or equivalent. Minimum accepted score as per SSC is 80%.
5	**Experience**	One year of experience as a certified Solar PV Engineer Or One year of experience as a certified Solar PV O&M Engineer Or Two years of experience in operating & maintaining of Solar PV power plants

CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role Solar PV O&M Engineer

Qualification Pack SGJ/Q0117

Sector Skill Council Green Jobs

Guidelines for Assessment

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
4. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below).
5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criterion.
6. To pass the Qualification Pack, every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.
7. In case of *unsuccessful completion*, the trainee may seek reassessment on the Qualification Pack.

Compulsory NOS **Total Marks: 350**			**Marks allocation**		
Assessment Outcomes	**Assessment Criteria for outcomes**	**Total Marks**	**Out of**	**Theory**	**Skills Practical**
SGJ/N0139 Carry out operation of solar PV power plant	PC1. check the voltage, current and power at different levels in the plant	**50**	5	2	3
	PC2. monitor the generation of power from the plant on hourly, daily , monthly, yearly basis		10	4	6
	PC3. ensure proper storage and retrieval of data from the monitoring system		5	2	3
	PC4. compute the metrics like performance ratio, capacity utilization factor etc.		5	2	3
	PC5. compare and analyse the actual generation with the theoretical simulation data and report any deviations		10	4	6
	PC6. identify the fault/s in the solar PV power plant and the cause of the identified fault/s		5	2	3
	PC7. take necessary corrective actions to restore the plant performance		10	4	6
		TOTAL	**50**	**20**	**30**
SGJ/ N0140 Carry out electrical maintenance of	PC1. prepare the preventive maintenance schedule in consultation with their senior	**100**	10	4	6

solar PV power plant	PC2. ensure proper functioning of the earthing and lightening protection system as per documented procedure		10	4	6
	PC3. ensure proper functioning of all electrical connections in a solar PV power plant up to the inverter input by maintaining it as per schedule		10	4	6
	PC4. ensure proper maintenance by adherence to the schedule for sequential standard troubleshooting activity of all individual electrical components of the solar PV power plant including modules, inverters, etc. taking into account all safety procedures and standards		10	4	6
	PC5. analyse thermography data to identify weak and loose connections in the solar PV power plant or defect in the module/cell		10	4	6
	PC6. ensure proper maintenance of the monitoring system		10	4	6
	PC7. analyse the causes of faults in the Solar PV power plant in case of interruption or drop in power generation and ensure appropriate corrective action is taken, considering all safety procedures and standards		12	5	7
	PC8. analyse the strings identified as faulty by the technician/s to detect/identify the root cause of the problem		12	6	6
	PC9. ensure cleaning of work areas by technicians post completion of the maintenance activity		8	2	6
	PC10. ensure complete documentation of the job completion forms with signature of the customer or supervisor as per relevant standards		8	3	5
		TOTAL	**100**	**40**	**60**
SGJ/ N0141 Carry out civil/mechanical maintenance of solar PV power plant	PC1. ensure structural integrity of the civil foundations and module mounting structures including clamping arrangements, tracking system etc. by maintaining them as per schedule and taking into account all safety procedures and standards	**100**	10	4	6
	PC2. ensure proper mounting of junction boxes/combiner boxes		10	4	6

	PC3. ensure there is no shadowing of modules during the day by periodically removing all obstacles including vegetation, etc.		8	3	5
	PC4. ensure proper cleaning of solar modules as per schedule		8	3	5
	PC5. ensure uninterrupted water supply for cleaning of solar modules		8	3	5
	PC6. ensure proper maintenance of the drainage system and inverter/control room is carried out		8	2	6
	PC7. ensure rectification of the internal roads and pathways between the arrays, as and when required, and prevent any water logging		8	2	6
	PC8. ensure rectification of any loose clamps, nuts and bolts, as and when required		8	2	6
	PC9. ensure proper functioning of the tracking system, as and when required		14	6	8
	PC10. ensure cleaning of work areas by technicians post completion of the maintenance activity		10	3	7
	PC11. ensure complete documentation of the job completion forms with signature of the customer or supervisor as per relevant standards		8	3	5
		TOTAL	**100**	**35**	**65**
SGJ/ N0106 Maintain personal health & safety at project site	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	0
	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 the project site		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
	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	0
	PC20. dismantle plant safely in accordance with sequence and remove from worksite to clear work area		2	1	1
		TOTAL	**50**	**29**	**21**
SGJ/ N0120 Work effectively with others	PC1. accurately pass on information to the authorized persons who require it and within agreed timescale and confirm its receipt	**50**	4	2	2
	PC2. assist others in performing tasks in a positive manner where required and possible		4	2	2
	PC3. consult and assist others to maximize effectiveness and efficiency in carrying out tasks		4	2	2
	PC4. display appropriate communication etiquette while working		6	3	3
	PC5. display active listening skills while interacting with others at work		4	2	2

	PC6. demonstrate responsible and disciplined behaviours at the workplace		4	2	2
	PC7. escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict		3	1	2
	PC8. identify the need for common grounds with clients, team members, etc. and negotiate in an effective manner to achieve the same		3	1	2
	PC9. consider and respect the opinions, creativity, values, beliefs and perspectives of others		4	2	2
	PC10. ensure collaboration and group participation to achieve common goals		6	3	3
	PC11. promote a friendly, co-operative environment that is conducive to employee's sense of belonging		4	2	2
	PC12. facilitate an understanding and appreciation of the differences among team members		4	2	2
		TOTAL	**50**	**24**	**26**