Model Curriculum

Solar PV Designer

SECTOR: GREEN JOBS
SUB-SECTOR: RENEWABLE ENERGY
OCCUPATION: Designer
REF ID: SGJ/Q0110, V1.0
NSQF LEVEL: 7

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 Designer**' QP No. '**SGJ/Q 0110 NSQF Level 7**'

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 Designer

CURRICULUM / SYLLABUS

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

Program Name	**Solar PV Designer**		
Qualification Pack Name & Reference ID.	SGJ/Q0110, v1.0		
Version No.	1.0	**Version Update Date**	1st Aug 2017
Pre-requisites to Training	B. Tech/ B.E. (Solar/ Electrical, Electronics, Civil, Mechanical/ Energy Systems) plus 3 years of Solar PV experience or M. Tech (Solar/ Renewables/ Energy Studies)		
Training Outcomes	**After completing this programme, participants will be able to:** • **Review the structural design of solar PV power plant** • **Review the electrical design of solar PV power plant and the energy simulation report** • **Maintain personal health & safety at solar PV project site** • **Work effectively with others**		

This course encompasses 4 out of 4 National Occupational Standards (NOS) of "Solar PV Designer" 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	**Review the structural design of solar PV power plant** **Theory Duration** (hh:mm) 30:00 **Practical Duration** (hh:mm) 42:00 **Corresponding NOS Code** SGJ/N0128	• study the soil test reports, water table depth report and pull test data to ensure the design meets requirement. • review the overall plant layout • review the layout for solar field compound wall /entry gate • review the layout for in plant roads with material specifications • review the design for water distribution network inside the plant • review the design for water drainage system • review the design for pathways between the solar arrays • review the design for the foundation for	Site visit for practical learning

		mounting solar PV panel support structure • review the design for the tilt brackets and mounting frames for solar panels with fastening arrangement • document the details of RCC foundation, plan of the inverter room • document the details of the bolt ,base plates etc. used in structure, foundation of inverter and control room • document the transformer foundation details • document the foundation and design details of the control room • review the design plan for earthing pits • review the design plan for lightning arrestor foundation • review the design plan for street light foundation • review the structural design for plant switchyard as per the grid code and transmission authority regulations • review the foundation plan for the transmission tower • review the design for structure of the transmission tower • review the design for stub and cleats of transmission tower • review the design for corridor of transmission line • review the foundation design for module mounting structures such that the dead and dynamic loads on modules are transferred to the beam and columns of the building • review the design for walk ways for maintenance of modules and system • review the design for movable mounting structure for canal top plant to increase output	
3	**Review the electrical design of solar PV power plant and the energy simulation report** **Theory Duration** (hh:mm) 32:00 **Practical Duration** (hh:mm) 48:00 **Corresponding NOS Code**	• analyze the availability of shadow free space available • analyze the global solar irradiation at the site • workout the capacity of the solar power plant • select solar module technology and size, based on analysis of cost, power output, quality, climatic conditions of the site, global and diffused irradiance ratio at the site etc • workout the total numbers of modules based on the total capacity of the plant and the capacity of selected modules	Licenced Solar Design software, Computer Lab

	SGJ/N0123	• review the earthing design of solar module arrays • select inverter, based on compatibility with module technology, compliance with grid code and other applicable regulations, reliability, system availability, serviceability, quality, cost, DC TO AC conversion efficiency • in case of a roof top power plant, decide on specifications of the inverter to power the AC loads in the building • decide on number of inverters to be used based on the capacity and specifications of the inverter selected • finalize the inverter layout and inverter locations on the basis of total capacity • review the earthing design of inverters • workout number of modules in a string based on the input voltage and MPPT voltage range of the inverter • workout number of strings connected to a combiner box based on minimum run of DC connecting cables to minimized DC losses • finalize the inter row distance between the solar modules on the basis of minimum inter row shading, adequate space for cleaning and maintenance of solar modules and the tilted to south at an angle that optimizes the annual energy yield • specify DC cabling material, size, type of PVC for cables connecting modules, junction boxes to the combiner boxes and combiner boxes to the inverter panels etc. • review the specification of DC connectors (plugs and sockets) to be used • review the design specifications for junction boxes/combiner including IP number • review the specifications for disconnects/switches • workout number of combiner boxes connected to one panel of the inverter based on the input current rating of the inverter • review islanding facility for grid connected power plant, in case of non-availability of grid • protect incorrect polarity, over-voltage and overload for the DC cables • decide on specification of charge	

		controller/ inverter to the control the overcharging/ discharging of batteries • select the suitable simulation software • feed the parameters in the software basis on the electrical design • prepare the energy simulation report • analyse the energy simulation report and provide to superiors • decide the battery storage capacity (AH) based on the number of days autonomy required (KWH/WH) and the depth of discharge of the battery bank • decide on the specifications for the charge controller/ inverter to control the overcharging/discharging of the batteries, prepare energy generation report using simulation software.	
4	**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 corporate policies required for workplace safety • identify requirements for safe work area and create a safe work environment • identify contact person when workplace safety policies are violated • provide information about incident/violation • identify the location of first aid materials and administer first aid • identify the PPE required for specific locations on-site • identify expiry dates and wear & tear issues of specified equipment • demonstrate safe and accepted practices for personal protection • identify environmental hazards associated with the project site • identify electrical hazards • identify personal safety hazards or work site hazards and mitigate hazards • select tools, equipment and testing devices needed to carry out the work • demonstrate safe and proper use of required tools and equipment • check access from ground to work area to ensure it is safe and in accordance with requirements • re-assess risk control measures, as required, in accordance with changed work practices and/or site conditions and undertake alterations • inspect/install fall protection and perimeter protection equipment ensuring adequacy for work and conformance to regulatory requirements	Safety helmet, Safety souse, Safety belt, , Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves

		• identify approved methods of moving tools and equipment to work area and minimize potential hazards associated with tools at heights • select and install appropriate signs and barricades • place tools and materials to eliminate or minimize the risk of items being knocked down • dismantle plant safely in accordance with sequence and remove from worksite to clear work area	
5	**Work effectively with others** **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 06:00 **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) 86:00 **Practical Duration** (hh:mm) 114:00	Licenced Solar Design software, Computer Lab , Site Visit for Practical Learning, Safety helmet, Safety souse, Safety belt, , Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves	

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 Designer" mapped to Qualification Pack: "SGJ/Q0110, 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/Q0110, 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**	B. Tech/ B.E. (Solar/ Electrical, Electronics, Civil, Mechanical/ Energy Systems) or M. Tech (Solar/ Renewables/ Energy Studies)
4a	**Domain Certification**	Certified for Job Role: "Solar PV Designer" mapped to QP: "SGJ/Q0110, 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**	5 years of Solar PV experience for B. Tech/ B.E. (Solar/ Electrical/ Electronics/ Civil/ Mechanical/ Energy Systems) Or 2 years of Solar PV experience for M. Tech (Solar/ Renewables/ Energy Studies/ Electrical/ Electronics/ Civil/ Mechanical)

CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role Solar PV Designer

Qualification Pack SGJ/Q0110

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/N0128 Review the structural design of Solar PV Power Plant	PC1. study the soil test reports, water table depth report and the pull test data to ensure design meets the requirement	**100**	12	5	7
	PC2. review the overall plant layout		6	3	3
	PC3. review the layout for solar field compound wall /entry gate		4	2	2
	PC4. review the layout for in plant roads with material specifications		4	2	2
	PC5. review the design for water distribution network inside the plant		6	3	3
	PC6. review the design for water drainage system		4	2	2
	PC7. review the design for pathways between the solar arrays		4	2	2
	PC8. review the design for the foundation for mounting solar PV panel support structure		4	2	2
	PC9. review the design for the tilt brackets and mounting frames for solar panels with fastening arrangement		4	2	2
	PC10. document the details of RCC foundation, plan of the inverter room		2	1	1
	PC11. document the details of the bolt ,base plates etc. used in structure, foundation of inverter and control room		2	1	1
	PC12. document the transformer foundation details		2	1	1
	PC13. document the foundation and design		2	1	1

	details of the control room				
	PC14. review the design plan for earthing pits		3	1	2
	PC15. review the design plan for lightning arrestor foundation		3	1	2
	PC16. review the design plan for street light foundation		3	1	2
	PC17. review the structural design for plant switchyard as per the grid code and transmission authority regulations		6	2	4
	PC18. review the foundation plan for the transmission tower		4	1	3
	PC19. review the design for structure of the transmission tower		4	1	3
	PC20. Review the design for stub and cleats of transmission tower		4	1	3
	PC21. review the design for corridor of transmission line		4	1	3
	PC22. review the foundation design for module mounting structures such that the dead and dynamic loads on modules are transferred to the beam and columns of the building		5	2	3
	PC23. review the design for walk ways for maintenance of modules and system		4	1	3
	PC24. review the design for movable mounting structure for canal top plant to increase output		4	1	3
		TOTAL	**100**	**40**	**60**
SGJ/N0129 Review the electrical design of solar PV power plant and the energy simulation report	PC1. analyze the availability of shadow free space available	**100**	4	1	3
	PC2. analyze the global solar irradiation at the site		4	1	3
	PC3. workout the capacity of the solar power plant		4	2	2
	PC4. select solar module technology and size, based on analysis of cost, power output, quality, climatic conditions of the site, global and diffused irradiance ratio at the site etc.		6	2	4
	PC5. workout the total numbers of modules based on the total capacity of the plant and the capacity of selected modules		4	2	2
	PC6. review earthing design of solar module arrays		4	2	2
	PC7. select inverter, based on compatibility with module technology, compliance with grid code and other applicable regulations, reliability, system availability, serviceability, quality, cost, DC TO AC conversion efficiency		4	2	2
	PC8. in case of a roof top power plant, decide on specifications of the inverter to power the AC loads in the building		4	2	2
	PC9. decide on number of inverters to be used based on the capacity and specifications of the inverter selected		2	1	1

	PC10. finalize the inverter layout and inverter locations on the basis of total capacity		4	1	3
	PC11. review the earthing design of inverters		2	1	1
	PC12. workout number of modules in a string based on the input voltage and MPPT voltage range of the inverter		2	1	1
	PC13. workout number of strings connected to a combiner box based on minimum run of DC connecting cables to minimized DC losses		2	1	1
	PC14. finalize the inter space between the solar modules on the basis of minimum inter row shading, adequate space for cleaning and maintenance of solar modules and the tilted to south at an angle that optimizes the annual energy yield		4	2	2
	PC15. specify DC cabling material, size, type of PVC for cables connecting modules, junction boxes to the combiner boxes and combiner boxes to the inverter panels etc.		4	1	3
	PC16. review the specification of DC connectors (plugs and sockets) to be used		2	1	1
	PC17. review the design specifications for junction boxes/combiner including IP number		2	1	1
	PC18. review the specifications for disconnects/switches		4	2	2
	PC19. workout number of combiner boxes connected to one panel of the inverter based on the input current rating of the inverter		2	1	1
	PC20. review islanding facility for grid connected power plant, in case of non- availability of grid		4	2	2
	PC21. protect incorrect polarity, over-voltage and overload for the DC cables		4	1	3
	PC22. decide on specification of charge controller/ inverter to the control the overcharging/ discharging of batteries		4	2	2
	PC23. select the suitable simulation software		1	1	0
	PC24. feed the parameters in the software basis on the electrical design		4	1	3
	PC25. prepare the energy simulation report		6	1	5
	PC26. analyze the energy simulation report and provide to superiors		5	2	3
	PC27. decide the storage battery capacity (AH) based on the number of days autonomy required (KWH/WH) and the depth of discharge of the battery bank		4	2	2
	PC28. decide on the specifications for the charge controller/ inverter to control the overcharging/discharging of the batteries, prepare energy generation report using simulation software		4	1	3
		TOTAL	**100**	**40**	**60**

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	**100**	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 behaviors 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**