

NATIONAL SKILL QUALIFICATION FRAMEWORK QUALIFICATION FILE

Version 6: Draft of 01st September 2016

CONTACT DETAILS OF THE BODY SUBMITTING THE QUALIFICATION FILE

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List of documents submitted in support of the Qualifications File

1. Qualifications Pack
2. Industry Validations letters
3. Industry Endorsement tracker
4. Integrated Occupational Map
5. Summary Sheet

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SUMMARY

Qualification Title	Solar PV Manufacturing Technician/ Operator
Qualification Code	QP SGJ/ Q0119
Nature and purpose of the qualification	Nature of the qualification - Working independently without any supervision The main purpose of the qualification - This Qualification will enable the individual to specialize in the manufacturing of solar PV modules
Body/bodies which will award the qualification	Skill Council for Green Jobs
Body which will accredit providers to offer courses leading to the qualification	Skill Council for Green Jobs
Body/bodies which will carry out assessment of learners	Affiliated Assessment Agency of SCGJ
Occupation(s) to which the qualification gives access	Solar PV Manufacturing Technician/ Operator
Licensing requirements	N/A
Level of the qualification in the NSQF	Level 4
Anticipated volume of training/learning required to complete the qualification	200 hours
Entry requirements and/or recommendations	10 th pass preferably and ability to read/write and communicate effectively on the job role occupationally competent in the area of Solar PV relevant to the training. No experience in the Solar PV sector is required
Progression from the qualification	Vertical Progression: Production Engineer (Level 5)
Planned arrangements for the Recognition of Prior learning (RPL)	SCGJ recognizes that there may be candidates who have prior learning experience in the Renewable Energy Sector and are desirous of being certified. - Propose to carry out RPL for candidates working in Solar, Banking or Project Finance organizations. - A bridge course would be conducted for people who are working in solar industry. - Linking of this Qualification to Start Up India
International comparability where known	NA
Date of planned review of the qualification.	30 th September 2019

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Formal structure of the qualification			
Title and identification code of component.	Mandatory/ Optional	Estimated size (learning hours)	Level
SGJ/ N0145 Carry out manufacturing of solar PV modules	Mandatory	160	4
SGJ/ N0147 Maintain personal health & safety in a manufacturing facility	Mandatory	20	2
SGJ/ N0120 Work effectively with others	Mandatory	20	4

Please attach any document giving further detail about the structure of the qualification – e.g. a Curriculum Document or a Qualification Pack.

Give the titles and other relevant details of the document(s) here. Include page references showing where to find the relevant information.

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SECTION 1 **ASSESSMENT**

Body/Bodies which will carry out assessment:

Affiliated Assessment Agency of SCGJ

How will RPL assessment be managed and who will carry it out?

The RPL assessment will be carried out through pre assessment, identifying the skills gaps, provide bridge training to cover the competency gap, where required, and then conduct final assessment of the candidates.

Confederation of Indian Industry (CII) or any other Affiliated Assessment Agency of SCGJ, as per RPL Policy and Guidelines

Describe the overall assessment strategy and specific arrangements which have been put in place to ensure that assessment is always valid, reliable and fair and show that these are in line with the requirements of the NSQF.

The emphasis is on examination of existing businesses through case study analysis and practical demonstration of skills and knowledge based on the performance criteria.

The assessment papers are developed by Subject Matter Experts (SME) available with the Assessment Agency, in collaboration with Skill Council for Green Jobs, as per the performance and assessment criteria mentioned in the Qualification Pack. The assessments papers are also checked for the various outcome based parameters such as quality, time taken, precision, tools & equipment requirement etc. The assessment sets are then reviewed for consistency. The technical limitations at the training centres are taken care in theory and viva.

The assessment agencies are instructed to hire assessors with integrity, reliability and fairness. Each assessor shall sign a document with its assessment agency by which they commit themselves to comply with the rules of confidentiality and conflict of interest, independence from commercial and other interests that would compromise impartiality of the assessments. The assessment agencies are instructed to identify assessors as per the Assessment Policy and Guidelines established by Skill Council for Green Jobs relevant for that Qualification.

The assessors selected by Assessment Agencies are scrutinized and made to undergo training and introduction to SCGJ Assessment Framework, competency based assessments, and assessors guides. The assessors are provided with assessors guide developed by the Subject Matter Expert of the assessment agency in collaboration with SCGJ as per the assessment framework. The assessment guides are developed to ensure the maximum possible consistency in the assessment by different assessors and elaborate on the following

- Qualification Pack Structure
- Guidance for the assessor to conduct theory, practical and viva assessments
- Guidance for trainees to be given by assessor before the start of the assessments.
- Guidance on assessments process, practical brief with steps of operations practical observation checklist and mark sheet
- Viva guidance for uniformity and consistency across the batch.

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The assessment by assessment agency is completely based on the assessment criteria as mentioned in the Qualification Pack. Each NOS in the Qualification Pack (QP) is assigned a relative weightage for assessment based on the criticality of the NOS. Therein each Performance Criteria in the NOS is assigned marks for or practical based on relative importance, criticality of function and training infrastructure.

The following tools are proposed to be used for final assessment:

Practical Assessment: This will comprise of a test to evaluate the individual's grasp on domain skills imparted.

Viva/Structured Interview: This tool will be used to assess the conceptual understanding and the behavioural aspects as regards the job role and the specific task at hand. It will also include questions to ascertain the soft skills of interacting with the customer or client.

Written Test: Under this test few key items which cannot be assessed practically will be assessed. The written assessment will comprise of:

- True / False Statements
- Multiple Choice Questions
- Problem Statements
- Case Study Analysis

Please attach any documents giving further information about assessment and/or RPL.

Give the titles and other relevant details of the document(s) here. Include page references showing where to find the relevant information.

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ASSESSMENT EVIDENCE

Complete a grid for each component as listed in “Formal structure of the qualification” in the Summary.

NOTE: this grid can be replaced by any part of the qualification documentation which shows the same information – i.e. Learning Outcomes to be assessed, assessment criteria and the means of assessment.

Title of Component: Solar PV Manufacturing Technician/ Operator

CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role Solar PV Manufacturing Technician/ Operator

Qualification Pack SGJ/ 0119

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.

Assessment Outcomes	Assessment Criteria for outcomes	Total Marks	Marks allocation		
			Out of	Theory	Skills Practical
SGJ/N0145 Carry out the manufacturing of solar PV modules	PC1. Sort the solar cells using a cell sorter and put use the cells with same specifications for making a cell string	100	6	2	4
	PC2. Monitor the assembly and interconnection of cells with metal ribbons to make a module		6	2	4
	PC3. Ensure the testing of solar cells as per standard operating procedures		6	3	3
	PC4. Cut EVA using a cutter and place it on the glass substrate		6	2	4
	PC5. Monitoring the process of aligning and placing cell strings on EVA sheet at assembler module layup station		6	2	4

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	PC6.	Monitor the process of completing the module laminate circuit at the busing station and provide output leads		7	2	5
	PC7.	Visually inspect and electrically test the module laminate circuit by measuring its I-V characteristics at an inspection station		7	2	5
	PC8.	Cut EVA back sheets to length using the cut and place station, and then assemble them with the glass and module circuit		6	2	4
	PC9.	Monitor the process to laminate the assembly and cure the EVA with the laminator		6	2	4
	PC10.	Trim the edges of the laminated module panel using cutter		4	1	3
	PC11.	Attach the junction box and bypass diodes		4	1	3
	PC12.	Install an edge gasket		4	1	3
	PC13.	Monitor the framing of solar module at a frame press station		4	1	3
	PC14.	Measure the module's performance under simulated sunlight		7	2	5
	PC15.	Perform the testing of solar modules as per relevant industry standards		7	2	5
	PC16.	Visually inspect the completed module for quality of materials and workmanship		6	2	4
	PC17.	Check proper packaging material for module		4	1	3
	PC18.	Pack modules in properly designed cartons for transportation		4	1	3
			TOTAL	100	31	69
SGJ/N0121 Maintain personal health & safety in a manufacturing facility	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		8	3	5
	PC7.	Identify expiry dates and wear & tear issues of specified equipment		2	1	1
	PC8.	Demonstrate safe and accepted practices for personal protection		8	3	5
	PC9.	Identify environmental hazards associated with the manufacturing facility		4	2	2
	PC10.	Identify electrical hazards		4	2	2

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	PC11. Identify personal safety hazards or work site hazards and mitigate hazards		6	3	3
	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		5	2	3
		TOTAL	50	24	26
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 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

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Means of assessment 1
Means of assessment 2
Pass/Fail

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SECTION 2 **EVIDENCE OF LEVEL**

Awarding bodies will enter a proposed NSQF level for the qualification in the Qualification File Summary. This section asks for the evidence on which that proposal is based. The evidence must refer to the level descriptors of the NSQF.

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NSDA recommends an approach to working out the level of qualifications which starts with the level descriptor domains (Process, Professional knowledge, Professional skill, Core skill and Responsibility: see annex A). Two variants for providing the evidence of level are offered here: Option A and Option B in the following pages. Awarding bodies should choose the option which best suits the qualification.

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OPTION A

Title/Name of qualification/component: Solar PV Manufacturing Technician/ Operator		Level: 4	
NSQF Domain	Key requirements of the job role	How the job role relates to the NSQF level descriptors	NSQF Level
Process	<p>The individual is expected to check and rectify the front glass cover for the PV modules, solder the solar cell to the strings, carry out the lamination of solar PV modules, frame the solar PV modules, tests the modules and packs it for transit.</p>	<p>The individual independently performs familiar, predictable, routine situation of clear choice such as sorting the solar cells using a cell sorters, assemble and carry out interconnection of cell using an assembler, carry out peel and gel test as per standard operating procedures, aligning and placing the cell strings on EVA, soldering the bus ribbons to connect the strings, visually and electrically inspecting the module laminate circuit by measuring its dark IV characteristics at the inspection station, completing the assembly of the laminated module using cutter, framing the module at a press station and carrying out the performance test of the module as per standard procedures like measuring performance under simulated sunlight, performing high voltage isolation test, etc. S/he also has to ensure proper packaging of modules for transportation.</p> <p>Hence, the role qualifies as a Level 4 role.</p> <p>The role requires working in familiar, predictable and routine situations of clear choice as the operating procedures are clearly established. For example, sorting of solar cells, carrying out assembling using an assembler, carrying out lamination of the module, conducting tests as per SOPs. In case of problems, the role holder is expected to escalate the issue to the production engineer. Hence, the role cannot be placed at level 5.</p> <p>This role requires the job holder to carry out work of a predictable and routine nature where the range of activities is not limited. The role holder is responsible for end to end</p>	4

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Title/Name of qualification/component: Solar PV Manufacturing Technician/ Operator			Level: 4
NSQF Domain	Key requirements of the job role	How the job role relates to the NSQF level descriptors	NSQF Level
		assembling, testing as well as packing of a solar PV module. For example, s/he is expected to sort the solar cells using a cell sorters, carry out assembly of solar cells, carry out peel and gel test, soldering the bus ribbons to connect the strings, lamination of solar module, carrying out testing of solar modules and packing the same for transportation. Hence, s/he cannot be placed at level 3.	
Professional knowledge	The individual is expected to be exhibit the knowledge of basic electrical concepts, basics of solar energy systems, raw material, shelf life and storage specifications of various equipment, cutting procedures of EVA and back sheet, soldering techniques, various types of tools, measuring equipment used for the manufacturing of solar PV modules, operation of various equipment such as laminators, framing machines, etc., typical faults and their rectification, etc.	<p>The job holder is expected to exhibit an understanding factual knowledge of the field of solar module manufacturing. For example, s/he is expected to have knowledge of the various raw materials used in the production of solar PV modules, their shelf life and storage specifications, basics of function of solar PV modules, usage of various measuring equipments such as multi-meter, solar array tester, meggar, etc., cutting procedures of EVA and back sheet, soldering techniques, various types of tools used for the manufacturing and their usage, operation of machines used for solar module manufacturing such as laminators, framing machines, etc., performance characteristics of solar cells and modules, etc., various faults which can occur in the machines and their troubleshooting, etc. S/he is also supposed to have the knowledge about the relevant occupational health and safety standards and various personal protective equipment to be used for carrying out manufacturing process. S/he should also have the ability to speak read and write in the local vernacular language and English.</p> <p>Since all the above mentioned areas are related to factual knowledge in the field of solar PV module manufacturing, the role qualifies for Level 4.</p> <p>The job holder is expected to know more than basic facts and principles applied in his/her trade. For example, s/he is</p>	4

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Title/Name of qualification/component: Solar PV Manufacturing Technician/ Operator			Level: 4
NSQF Domain	Key requirements of the job role	How the job role relates to the NSQF level descriptors	NSQF Level
		<p>expected to have detailed knowledge of the various raw materials used in the production of solar PV modules, their shelf life and storage specifications, detailed knowledge of the usage of various measuring equipments such as multi-meter, solar array tester, meggar, etc., soldering techniques, various types of tools used for the manufacturing and their usage, operation of machines used for solar module manufacturing such as laminators, framing machines, etc., performance characteristics of solar cells and modules, etc., various faults which can occur in the machines and their troubleshooting, etc. S/he is also supposed to have the knowledge about the relevant occupational health and safety standards and various personal protective equipment to be used for carrying out manufacturing process. Hence the role cannot be pegged at level 3.</p> <p>Further, since the job holder is not expected to be aware of principles/ process & general concepts in the field of manufacturing as a whole, it can't be pegged at level 5. For example, this role is not expected to possess knowledge about the fault rectification of various machines apart from simple troubleshooting procedures. Further the role incumbent is not expected to possess the knowledge about the quality control procedures of solar PV modules, maintenance procedures of the various machines and equipment.</p>	
Professional skill	The job holder is expected to operate/ use screw driver, inspection fixtures, wire cutter, pliers, testers, spanner, etc., plan and organize the regular activities to be conducted at the solar module manufacturing facility. Further, the job holder must be able to take the day to day decisions and solve problem/s at work. The job holder should also be able to critically analyse the	The job holder is expected to carry out routine and repetitive activities in a narrow range of application, using appropriate rule and tool. For instance, the job holder has to sort the solar cells using a cell sorters, assemble and carry out interconnection of cell using an assembler, carry out peel and gel test as per standard operating procedures, align and place the cell strings on	4

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Title/Name of qualification/component: Solar PV Manufacturing Technician/ Operator			Level: 4
NSQF Domain	Key requirements of the job role	How the job role relates to the NSQF level descriptors	NSQF Level
	information gathered from different channels like current, voltage readings etc. to identify the possible faults and escalate to the production engineer	<p>EVA, solder the bus ribbons to connect the strings, visually and electrically inspect the module laminate circuit by measuring its dark IV characteristics at the inspection station, complete the assembly of the laminated module using cutter, frame the module at a press station and carry out the performance test of the module as per standard procedures like measuring performance under simulated sunlight, perform high voltage isolation test, etc. S/he also has to ensure proper packaging of modules for transportation</p> <p>All these activities are repetitive as they relate to following already established SOPs. Hence this role qualifies for level 4.</p> <p>As this job requires a lot of experience and observation skills, for example, the job holder is expected for analyse critical points in day to day tasks through experience for example the operation of different machines, etc. and escalate the same to the production engineer, arrange for the tools, etc. required for the production of solar modules, organize raw materials and packaging materials required for all products, plan to utilise time and equipment's effectively, etc. Therefore, it cannot be pegged at level 3.</p> <p>Further the job holder doesn't require to solve problems by selection and applying methods, tools, materials and information, but rather follow standard operating procedures established at the manufacturing plant. Hence, s/he can't be placed at level 5.</p>	
Core skill	The job holder is required to have core skills for performing the job which includes: writing skills, reading skills, and oral and communication skills (listening and speaking skills). For example the job holder is expected	The job holder is expected to exhibit effective oral communication skills (including awareness of vernacular language) so as to understand the instructions of the supervisor as well as clearly communicate with team	4

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Title/Name of qualification/component: Solar PV Manufacturing Technician/ Operator			Level: 4
NSQF Domain	Key requirements of the job role	How the job role relates to the NSQF level descriptors	NSQF Level
	<p>to note the information communicated by the supervisor, read and interpret the process required for producing various types of products, discuss task lists, schedules, and activities with the supervisor, effectively communicate with team members, read equipment manuals and process documents to understand the equipments operation and process requirement</p>	<p>members. The job holder is also expected to possess reading and writing skills so as to read and understand equipment manuals, health and safety instructions, various signage and standard code and concepts well as well as maintain daily records as per organisation policies for work like details about defects, breakdowns, etc. and write information documents to other teams. The job holder is also expected to display basic arithmetic/ algebraic awareness to analyse and interpret the evaluation parameters of equipment such as the standard current, voltage level, the accepted resistance levels for different components, etc. The incumbent must understand the social, political of the local environment so as to communicate effectively with helpers, etc. who primarily belong to the surrounding regions.</p> <p>Since all the above mentioned core skills are related to exhibiting effective oral, written communication skills along with basic understanding of the arithmetic principles as well as some basic understanding of the social, political environment, the role qualifies for Level 4.</p> <p>As this job requires having direct communication with the supervisor for the discussion about the tasks and schedules, For Example, the job holder is expected to discuss task lists, schedules and activities with the supervisor , read and interpret the process required for producing various types of products, effectively communicate with team members , communicate clearly with the supervisor and cross department teams on the issues faced during the process , question the supervisor in order to understand the nature of the problem and to clarify queries. Therefore, it cannot be pegged at level 3.</p>	

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Title/Name of qualification/component: Solar PV Manufacturing Technician/ Operator			Level: 4
NSQF Domain	Key requirements of the job role	How the job role relates to the NSQF level descriptors	NSQF Level
Responsibility	The individual is primarily responsible to gain knowledge about standard protocols and SOPs regarding the solar module manufacturing and update self, regarding the operation and basic troubleshooting of various machines through on-the job learning, manuals, etc.	<p>Further since the job holder doesn't require to use detailed mathematical skill or skill of collecting & organizing information such as collecting information regarding plant operation, efficiency, etc. to anticipate faults and taking corrective actions, etc. s/he can't be placed at level 5</p> <p>The solar PV manufacturing technician/ operator is responsible for his/ her own work and learning. S/he is expected to update self with the standard protocols and SOPs using the available equipment manuals, etc. S/he is also expected to have significant on the job learning about the machines, their operations and basic troubleshooting procedures S/he works under some supervision but primarily carries out his/her day to day activities independently. Only in cases where a problem arises s/he takes the support of the production engineer. Thus s/he can be placed at level 4.</p> <p>Since s/he is neither expected to be responsible of other's work and learning by hence s/he can't be placed at level 5.</p> <p>Also as the role incumbent does not work under close supervision and has full responsibility for own learning, s/he can't even be placed at Level 3.</p>	4

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SECTION 3

EVIDENCE OF NEED

What evidence is there that the qualification is needed?

During extensive industry interactions carried out while creating occupational maps and prioritization of job roles for Qualification Pack development, the mentioned qualification was indicated as a key requirement by the industry. In addition, the Skill Gap Report for the sector has indicated that a significant proportion of the workforce is involved in this work function. The study also indicates that this domain will be in great demand, due to focus of Government of India to support the sector through policy and implementation. Research was conducted in the Renewable energy sector manpower requirement estimates till 2025. The research provides the data that the discussed qualification is one of the critical roles in the sector. The details of statistics and research analysis are provided separately as a research analysis report

Evidence of the qualification is supported by validations with representation from across sub sectors .The complete list of validating companies has been enclosed as an annexure to the Q file.

What is the estimated uptake of this qualification and what is the basis of this estimate?

There is a significant increase in manpower requirements which is driven by government policies and initiatives like "Make in India", FDI, etc. It is estimated that domestic manufacturing of solar modules will increase significantly.

What steps were taken to ensure that the qualification(s) does/do not duplicate already existing or planned qualifications in the NSQF?

Currently, Skill Council for Green Jobs is the only Sector Skill Council set up which has the mandate of Certification and Assessment of candidates undergoing Skill Development courses in Solar Photovoltaic domain. NSDC list of Approved QPs was checked prior to commissioning the work. There is no overlap of these Qualification Packs with existing Qualification Packs. The NCO/2015 Classification and MES Course List was also cross examined for existing trades, wherein no overlap / existing trade was found.

What arrangements are in place to monitor and review the qualification(s)? What data will be used and at what point will the qualification(s) be revised or updated?

In the Qualification Pack, review date is scheduled for after 3 years in consultation with Subject Matter Experts. The monitoring of evaluation of assessments and Employer feedback will be sought post-placement, for review of the effectiveness of the Qualification.

Please attach any documents giving further information about any of the topics above.

Give the titles and other relevant details of the document(s) here. Include page references showing where to find the relevant information.

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SECTION 4

EVIDENCE OF PROGRESSION

What steps have been taken in the design of this or other qualifications to ensure that there is a clear path to other qualifications in this sector?

1. Discussing the growth trajectory within each occupation after studying organisational charts of various industry players across small, medium and large scale organizations.
2. Exploring various lateral career opportunities for the discussed qualification
3. Ensuring that there is a clear role up in terms of performance criteria qualification experience and skill requirement from lower NSQF Level to higher levels in the hierarchy.

Please refer to attached career path as per annexure 1 which clearly defines the career path.

Please attach any documents giving further information about any of the topics above.

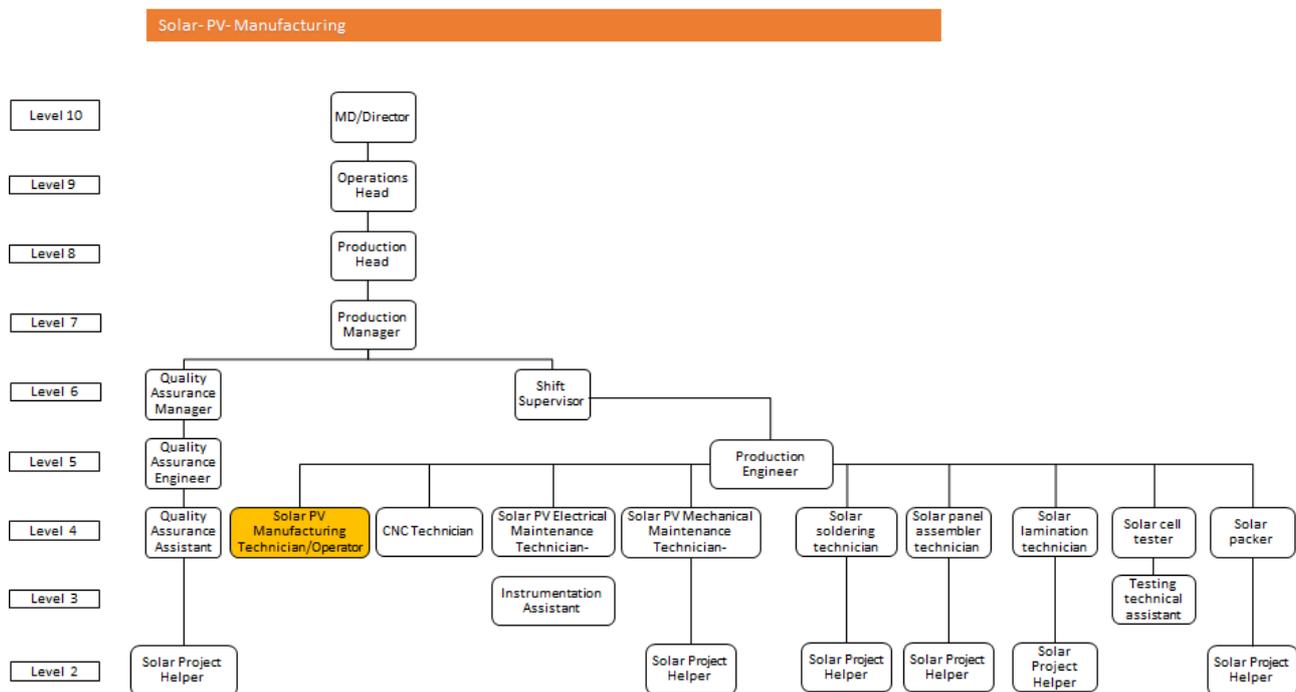
Give the titles and other relevant details of the document(s) here. Include page references showing where to find the relevant information.

1. Career Map of Solar PV Manufacturing Technician/ Operator - Annexure 1
2. QP SGJ/Q0119 - Annexure 2

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Annexure 1: Career Map



Solar PV Manufacturing Technician/ Operator is a blanket QP which covers all activities related to solar module manufacturing.

Annexure 2: QP SGJ/ Q0119