QUALIFICATION FILE

Solar PV Cell Manufacturing Technician

☒ Short Term Training (STT) ☐ Long Term Training (LTT) ☐ Apprenticeship

☐General ☐ Multi-skill (MS) ☐ Cross Sectoral (CS) ☒ Future Skills ☐ OEM

NCrF/NSQF Level: 4

Submitted By:

Skill Council for Green Jobs Chief Executive Officer
CBIP Building, Malcha Marg,
Chankyapuri, New Delhi – 110021
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Section 1: Basic Details

1.	**Qualification Name**	**Solar PV Cell Manufacturing Technician**	
2.	**Sector/s**	**Environmental Science**	
3.	**Type of Qualification: ☒ New**	**NQR Code & version of existing/previous qualification:** **N/A**	**Qualification Name of existing/previous version:** **N/A**
4.	**a. OEM Name** **b. Qualification Name** (Wherever applicable)	**Solar PV Cell Manufacturing Technician**	
5.	**National Qualification Register (NQR) Code &Version**	**QG-04-ES-00147-2023-V1-SCGJ & version 1**	**6. NCrF/NSQF Level: 4**
7.	**Award (Certificate/Diploma/Advance Diploma/ Any Other**	Certificate	
8.	**Brief Description of the Qualification**	Solar PV Cell Manufacturing Technician performs solar cell manufacturing tasks in a production line, cleans silicon wafer, undertake chemical and thermal processing in making solar cells. The job holder operates various stations including metallization processes and is also responsible for testing and packaging of solar cells.	

9.	**Eligibility Criteria for Entry for Student/Trainee/Learner/Employee**	**a. Entry Qualification & Relevant Experience:**

S. No.	Academic/Skill Qualification (with Specialization - if applicable)	Required Experience (with Specialization - if applicable)
1	12th Grade Pass	NA
2	8th grade pass with 2-year NTC plus 1 year NAC plus 1 year CITS	NA
3	10th grade pass plus 2-year NTC	NA
4	10th grade pass plus 1-year NTC plus 1 year NAC	NA
5	Completed 2nd year of 3-year diploma (after 10th) and pursuing regular diploma	NA
6	Previous relevant Qualification of NSQF Level (3.0 with minimum education as 8th Grade pass)	with 3 Years of experience relevant experience
7	Previous relevant Qualification of NSQF Level 3.5	with 1.5 years of relevant experience

b. Age: 18

10.	**Credits Assigned to this Qualification, Subject to Assessment** (as per National Credit Framework (NCrF))	14	**11. Common Cost Norm Category: I**
12.	**Any Licensing requirements for Undertaking Training on This Qualification** (wherever applicable)	NA	
13.	**Training Duration by Modes of Training Delivery** (Specify **Total Duration** as per selected training delivery modes and as per requirement of the qualification)	☒**Offline** ☐**Online** ☐**Blended**	

Training Delivery Modes	Theory (Hours)	Practical (Hours)	OJT Mandatory (Hours)	OJT Recommended (Hours)	Employability (Hours)	Total (Hours)
Classroom (offline)	130	110	120		60	420
Online (Refer Blended Learning Annexure for details)						

14.	**Aligned to NCO/ISCO Code/s** (if no code is available mention the same)	NCO-2015/7422.1901 Assembly Line Operator

15.	**Progression path after attaining the qualification** (Please show Professional and Academic progression)	Vertical Progression: Production Supervisor (Level 5)	
16.	**Other Indian languages in which the Qualification & Model Curriculum are being submitted**	**Nil**	
17.	**Is similar Qualification(s) available on NQR-if yes, justification for this qualification**	☐ **Yes** ☒ **No**	
18.	**Is the Job Role Amenable to Persons with Disability**	☒ **Yes** ☐ **No** **If "Yes", specify applicable type of Disability:** ☒ **Deaf** ☒ **Hard of Hearing** ☒ **Acid Attack Victims** ☒ **Dwarfism**	
19.	**How Participation of Women will be Encouraged**	The programme would be proposed to be incorporated in women ITIs and diploma colleges to train women candidates on the job role. TPs shall be encouraged to onboard at least a certain number of female candidates in each batch.	
20.	**Are Greening/ Environment Sustainability Aspects Covered** (Specify the NOS/Module which covers it)	☒ **Yes** ☐ **No**	
21.	**Is Qualification Suitable to be Offered in Schools/Colleges**	**Schools** ☐ **Yes** ☒ **No** **Colleges** ☒ **Yes** ☐ **No**	
22.	**Name and Contact Details of Submitting / Awarding Body SPOC** (In case of CS or MS, provide details of both Lead AB & Supporting ABs)	**Name: Arpit Sharma** **Email:** ceo@sscgj.in **Contact No.:** 9899505533 **Website:** https://sscgj.in/	
23.	**Final Approval Date by NSQC:** 31.01.2023	**24. Validity Duration:** 3 years	**25. Next Review Date:** 30.01.2026

Section 2: Module Summary

NOS/s of Qualifications

(In exceptional cases these could be described as components)

Mandatory NOS/s:

Specify the training duration and assessment criteria at NOS/ Module level. For further details refer curriculum document.

Th*.-Theory* ***Pr.****-Practical* ***OJT****-On the Job* ***Man.****-Mandatory Training* ***Rec.****-Recommended* ***Proj.****-Project*

S. No	NOS/Module Name	NOS/Module Code & Version (if applicable)	Core/ Non-Core	NCrF/N SQF Level	Credits as per NCrF	Training Duration (Hours)					Assessment Marks					
						Th.	Pr.	OJT-Man.	OJT-Rec.	Total	Th.	Pr.	Proj.	Viva	Total	Weightag e (%) (if applicable)
1.	SGJ/N3105 : Describe the basics of PV Cell, prepare & identify the bill of material and its specification	SGJ/N3105 version 1	Core	4	2	40	20	-	-	60	60	40	-	-	100	25
2.	SGJ/N3104: : Perform Solar cell manufacturing – Chemical Process	SGJ/N3104 version 1	Core	4	1	15	15	-	-	30	24	26	-	-	50	12
3.	SGJ/N3103: Perform Solar cell manufacturing – Thermal Process	SGJ/N3103 version 1	Core	4	1	15	15	-	-	30	24	26	-	-	50	12

S. No	NOS/Module Name	NOS/Module Code & Version (if applicable)	Core/ Non-Core	NCrF/NSQF Level	Credits as per NCrF	Training Duration (Hours)					Assessment Marks					
						Th.	Pr.	OJT-Man.	OJT-Rec.	Total	Th.	Pr.	Proj.	Viva	Total	Weightage (%) (if applicable)
4.	SGJ/N3102: Solar Cell Manufacturing – Metallization Process	SGJ/N3102 version 1	Core	4	1	15	15	-	-	30	24	26	-	-	50	12
5.	SGJ/N3101: Packing of Solar PV Cell	SGJ/N3101 Version 1	Core	4	2	30	30	-	-	60	50	50	-	-	100	13
6.	SGJ/N0147: Maintain personal health & safety in a manufacturing facility	SGJ/N0147 Version 1	Core	4	1	15	15	-	-	30	24	26	-	-	50	13
7.	DGT/VSQ/ N0102 Employability Skills	DGT/VSQ/ N0102 Version 1	Non-Core	4	2	60		-	-	60	20	30	-	-	50	13
8.	OJT			4	4	-		-	-	120			-	-		
Duration (in Hours) / Total Marks					14	190	110	120	0	420	226	224	-	-	450	100

Assessment - Minimum Qualifying Percentage

Minimum Pass Percentage – Aggregate at qualification level: 70 % *(Every Trainee should score specified minimum aggregate passing percentage at qualification level to successfully clear the assessment.)*

Section 3: Training Related

1.	Trainer's Qualification and experience in the relevant sector (in years) (as per NCVET guidelines)	Graduate/Diploma(Technical) with Two years of experience in a solar PV Cell manufacturing plant Or Certified under relevant Craft Instructor Training Scheme (CITS) course
2.	Master Trainer's Qualification and experience in the relevant sector (in years) (as per NCVET guidelines)	Engineering Graduate with 5 years of Solar cell production line experience
3.	Tools and Equipment Required for Training	☒Yes ☐No (If "Yes", details to be provided in Annexure)
4.	In Case of Revised Qualification, Details of Any Upskilling Required for Trainer	Not Applicable

Assessment Related

1.	Assessor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines)	Graduate/Diploma(Technical) with Three years of experience in a solar PV Cell manufacturing plant Or Certified under relevant Craft Instructor Training Scheme (CITS) course
2.	Proctor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines)	Engineering Graduate with 6 years of experience in a solar PV Cell manufacturing plant
3.	Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines)	Engineering Graduate with 7 years of experience in a solar PV Cell manufacturing plant
4.	Assessment Mode (Specify the assessment mode)	Online and offline both
5.	Tools and Equipment Required for Assessment	☒ Same as for training ☒ Yes ☐ No (details to be provided in Annexure-if it is different for Assessment)

Section 5: Evidence of the need for the Qualification

Provide Annexure/Supporting documents name.

1.	**Latest Skill Gap Study (not older than 2 years) (Yes/No):** Yes available at https://sscgj.in/wp-content/uploads/2022/03/Green-Jobs-Report-Jan27.pdf
2.	**Latest Market Research Reports or any other source (not older than 2 years) (Yes/No):** **Yes available at** https://sscgj.in/wp-content/uploads/2022/03/Green-Jobs-Report-Jan27.pdf https://jmkresearch.com/wp-content/uploads/2022/02/Photovoltaic-Manufacturing-Outlook-in-India_February-2022_JMK.pdf
3.	**Government /Industry initiatives/ requirement (Yes/No):** Yes, **Government /Industry initiatives/ requirement (Yes/No):** The term solar manufacturing largely refers to the production and assembly of the entire components of solar value chain with solar cells and modules being some key examples. Polysilicon is the building block for solar PV manufacturing from which ingots are cast. Wafers cut from ingots are then used to make solar cells, after which modules are assembled. Globally, the manufacturing of polysilicon, ingot and wafer is dominated by China but to ensure energy security and the viability of solar power projects in the country, Government of India has taken a range of steps for boosting domestic solar manufacturing. As per the latest approved list of manufacturers and models of Solar PV Modules (ALMM) issued by MNRE1, the current enlisted capacity for manufacturing solar PV modules in India is ~10 GW and the installed capacity for manufacturing solar PV cells is ~3 GW with no manufacturing capacity for polysilicon/Wafers/Ingots. In order to boost demand for locally manufactured solar cell and modules, the government schemes including central public sector undertaking (CPSU) scheme, phase 2 of grid connected rooftop solar program and PM–KUSUM scheme mandate domestic content requirement for sourcing solar PV modules. The government has also issued amendments to ALMM order, 2019 clarifying that only the models and manufacturers enlisted under ALMM will be eligible for use in a range of Government supported solar projects.

	Government plans to create an additional domestic solar equipment manufacturing capacity of 25 GW each of solar cells and modules, and 10 GW of wafers by April 2023. Considering the strategic importance of augmenting the capability for domestic manufacturing, the plan follows an additional allocation of Rs 19,500 crore2 for the production-linked incentive (PLI) scheme for high-efficiency solar modules in the FY22-23 Union budget. This is in addition to the Rs 4,500 crore already allocated to the scheme for manufacturing solar photovoltaic modules. The manufacturing push comes as India's plan to impose a basic customs duty of 40% on modules and 25% on solar cell imports from 1 April 2022. The PLI scheme supported with a range of other measures will incentivize domestic and foreign manufacturers to build gigawatt scale, vertically integrated solar manufacturing facilities in India. The government aims at achieving 10 GW capacity of integrated solar PV manufacturing plants in India within two years through the PLI scheme which is expected to drive a direct investment of around INR14,000 crore and thereby creating many jobs in the sector. Rapid solar deployment is the backbone of India's climate ambitions and energy security and a thriving domestic manufacturing industry would also generate new jobs along with delivering on growth and sustainability. During the extensive industry interactions carried out with solar industry while creating occupational maps and prioritization of job roles for Qualifications development, manufacturing focussed job roles was indicated as a key requirement by the solar manufacturing industry. It is important to note that SCGJ already has a qualification on Solar Module Manufacturing and the concerned qualification further complements that to ensure certified candidates are readily available to meet the growing requirements of the solar manufacturing companies.
4.	**Number of Industry validation provided: 10,** India currently has a very limited solar cell manufacturing facility. In view of Government encouragement for indigenous production, M/s Adani Solar is coming up with a large manufacturing facility of 1GW. Adani Solar has helped in preparing the qualification with its validation. In addition 8 other solar companies have provided validation for the job role.
5.	**Estimated nos. of persons to be trained and employed:** A large number of workforce shall be employed primarily at Solar PV cells and module manufacturing sites. There is a significant increase in manpower requirements which is driven by government policies and initiatives like "Make in India", FDI, production-linked incentive (PLI) scheme etc. It is estimated that domestic manufacturing of solar cells and modules will increase significantly and new jobs opportunities shall be created. Most of these will be created in the private sector but in some cases PSUs shall also set up/expand into solar manufacturing. With so much focus on promoting domestic manufacturing, Industry shall require trained and skilled manpower to perform a range of functions in solar manufacturing facilities. It is estimated that at least 15,000 trained technicians shall be required every year till 2025 and further doubling to 30,000 every year till 2030.
6.	**Evidence of Concurrence/Consultation with Line Ministry/State Departments:** Concurrence has been requested from the Ministry of New and Renewable Energy

Section 6: Annexure & Supporting Documents Check List

Specify Annexure Name / Supporting document file name

1.	**Annexure:** NCrF/NSQF level justification based on NCrF level/NSQF descriptors *(Mandatory)*	Annexure: Evidence of Level
2.	**Annexure:** List of tools and equipment relevant for qualification *(Mandatory, except in case of online course)*	Annexure: Tools and Equipment (Lab Set-Up)
3.	**Annexure:** Detailed Assessment Criteria *(Mandatory)*	Annexure: Detailed Assessment Criteria (Mandatory)
4.	**Annexure:** Assessment Strategy *(Mandatory)*	Annexure: Assessment Strategy
5.	**Annexure:** Acronym and Glossary *(Optional)*	Annexure: Acronym and Glossary
6.	**Supporting Document:** Model Curriculum *(Mandatory – Public view)*	Attached
7.	**Supporting Document:** Career Progression *(Mandatory - Public view)*	Annexure: Career progression and OM
8.	**Supporting Document:** Occupational Map *(Mandatory)*	Annexure: Career progression and OM
9.	**Supporting Document:** Assessment SOP *(Mandatory)*	Annexure: Assessment Strategy

Annexure: Evidence of Level

Title/Name of qualification/component: Solar PV Cell Manufacturing TechnicianL			Level: 4
NCrF/NSQF Level Descriptors	**Key requirements of the job role/ outcome of the qualification**	**How the job role/ outcomes relate to the NCrF/NSQF level descriptor**	**NCrF/NSQF Level**
Professional Theoretical Knowledge/Process	Solar PV Cell Manufacturing Technician performs the solar cell manufacturing tasks in a production line, cleans silicon wafer, undertake chemical and thermal processing in making solar cells. He operates various stations including metallization processes. He is also responsible for testing and packaging of solar cells Specialized knowledge Possesses specialized knowledge of solar energy, process involved in manufacturing of solar cells including chemical treatment of silicon wafers, formation of p-n junctions in silicon, operation of automatic work stations for processing silicon wafer to solar cells. He/She should understand financial and feasibility aspect of processes involved in making solar cells.	The individual independently performs familiar, predictable, routine situation of clear choice such as sorting the silicon wafer using wafer sorter, carry out chemical cleaning of wafer, thermal treatment to make p-n junction, anti reflection coating on wafers and screen printing of front and back contacts. Hence, the role qualifies as a Level 4 role. The role requires working in familiar, predictable and routine situations of clear choice as the operating procedures are clearly established. For example, sorting of silicon wafer and solar cells. 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. 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 process of making solar cells, testing as well as packing. For example, s/he is expected to sort silicon wafers and solar cells using a cell sorters, Hence, s/he cannot be placed at level 3.	4

Title/Name of qualification/component: Solar PV Cell Manufacturing Technician Level: 4			
NCrF/NSQF Level Descriptors	**Key requirements of the job role/ outcome of the qualification**	**How the job role/ outcomes relate to the NCrF/NSQF level descriptor**	**NCrF/NSQF Level**
Professional and Technical Skills/ Expertise/ Professional Knowledge	The individual is expected to be exhibit the professional skill and precision to prepare wafers and identify defects in solar cell manufacturing. He/she can identify various tools and equipment used for preparation of solar cells such as Multi meter, PPE, Carrier, Trolley, Tube cleaning rod, Layup bench, Cell Sorter, EL tester, etc..	The job holder is expected to exhibit an understanding and skill to identify various raw materials used in the production of solar PV cell, their shelf life and read storage specifications. He/She is expected to use various measuring equipment such as multi-meter, resistivity measurement, etc. He/she is expected to operate machines used for solar cell manufacturing such as diffusion furnace, screen printing, performance characteristics of solar cells, etc. S/he is also supposed to maintain occupational health and safety standards and use personal protective equipment to carrying out manufacturing process. Since all the above mentioned areas are related to identification of tools and required precision to perform specific work of manufacturing of solar cell, the role qualifies for Level 4. 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. S/he is expected to have professional knowledge to use various measuring equipment such as multi-meter, cell resistivity measurement, screen printing techniques, various types of tools used for the manufacturing. Hence the role cannot be pegged at level 3.	4

Title/Name of qualification/component: Solar PV Cell Manufacturing Technician Level: 4			
NCrF/NSQF Level Descriptors	**Key requirements of the job role/ outcome of the qualification**	**How the job role/ outcomes relate to the NCrF/NSQF level descriptor**	**NCrF/NSQF Level**
		Further, since the job holder is not expected to be have skills for process control and do statistical analysis to rectify defects in manufacturing. S/he need to communicate to Supervisor or higher authority to cater the same. So, it can't be pegged at level 5.	
Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	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. He/ She is also expected to use digital services with their associated application and features, safely and securely. The job holder is expected to understand the legal right, laws, aids, etc. The Job holder is expected to use various offline and online job search sources such as employment exchanges, recruitment agencies, and job portals respectively to outshine his/her career in field of solar energy	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 members. The Job holder is also expected to identify career development plan with well defined short- and long-term goals. The incumbent must understand the social, political of the local environment. He/ She is also expected to use digital services with their associated application and features, safely and securely. Since all the above-mentioned employability skills are related to exhibiting effective oral, written communication skills along team work capability, the role qualifies for Level 4. 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	4

Title/Name of qualification/component: Solar PV Cell Manufacturing Technician Level: 4			
NCrF/NSQF Level Descriptors	**Key requirements of the job role/ outcome of the qualification**	**How the job role/ outcomes relate to the NCrF/NSQF level descriptor**	**NCrF/NSQF Level**
		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. Further since the job holder doesn't require to have advance digital skill to control process of manufacturing of solar cell and anticipate faults and taking corrective actions, etc. s/he can't be placed at level 5	
Broad Learning Outcomes/Core Skill	The job holder is 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 job holder is expected 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 equipment operation and process requirement.	Since the job holder is expected to carry out routine and repetitive activities in a narrow range of application, using appropriate rule and tool, 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. S/he expected 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. Hence this role qualifies for level 4.	4
Responsibility	The individual is primarily responsible to gain knowledge about standard protocols and SOPs regarding the solar cell manufacturing and update self, regarding the operation and basic troubleshooting of various machines through on-the job learning, manuals, etc. H/She is also responsible for some	The Solar PV cell Manufacturing Technician 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	4

Title/Name of qualification/component: Solar PV Cell Manufacturing Technician Level: 4			
NCrF/NSQF Level Descriptors	**Key requirements of the job role/ outcome of the qualification**	**How the job role/ outcomes relate to the NCrF/NSQF level descriptor**	**NCrF/NSQF Level**
	learning of Junior technician who perform manual check of defects of solar cells.	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. 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. 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.	

Annexure: Tools and Equipment (Lab Set-Up)

List of Tools and Equipment

Batch Size:30

S. No.	Tool / Equipment Name	Specification	Quantity for specified Batch size
1	EL tester	Nos	3
2	Cell Sorter	No	1
3	Layup bench	No	1
4	Flow chart of Diffusion & PECVD processes	No	1
5	resistivity check equipment	No	1
6	Bath Tank	No	1
7	Material Safety Data Sheet	Each	1
8	Paper roll	No	1
9	Squeegee Holder	No	1
10	Tube cleaning rod	Nos	3
11	Tweezer	Nos	3
12	Quartz Boat	Nos	1
13	Graphite Boat	No	1
14	Trolley	No	1
15	Carrier	No	1
16	PPEs	Each	1
17	Raw Wafer	Nos	3
18	cautions used at plant	Nos	5
19	Notice board	No	1
20	Sample signs	Nos	5
21	Multi meter	Nos	3
22	Solar Cell	Nos	3
23	Raw Silicon Wafer	Nos	2
24	Solar Cell manufacturing flow chart	No	1
25	charts	Nos	5
26	Projector	No	1
27	Marker	Pieces	5
28	white board	Each	1
29	Laptop	Pieces	3

Classroom Aids

The aids required to conduct sessions in the classroom are: Marker, chart and visual aid;

Annexure: Industry Validations Summary

Provide the summary information of all the industry validations in table. This is not required for OEM qualifications.

S. No	Organization Name	Representative Name	Designation	Contact Address	Contact Phone No	E-mail ID	LinkedIn Profile (if available)
1	Adani Solar	Mr Vijay Saxena	AVP, HR	Mundra Solar Technopark Pvt Ltd. Electronics Manufacturing Cluster (EMC); Survey No 180 P, village Vandh & Tunda, Taluka; Mundra— 370435; District- Kutch, Gujarat, INDIA	9099991003	vijay.saxena@adani.com	NA
2	IB Solar	Mr Abhinav Mahajan	Director	D-127, Sec-63 Noida 20130	9810012731	abhinav@ibsolar.co.in	NA
3	GISE	Ms Dipti Shah	Director	Gujarat Institute of Solar Energy, ISt Floor, Giriraj complex, Opp. Bank of Baroda, Near Sardar Patel Statue, Naranpura, Ahmedabad-380014, Gujarat,	9898167732	info@gise.in	NA
4	GRI	Dr Kirubakran	Assoc. Professo & Director	The Gandhigram Rural Institute — Deemed to be University Gandhioram 624 302 Tamilnadu	94438 59066	kirbakaran@yahoo.com	NA
5	OPPL	Mr Rupal Gupta	Director	M/S Oriana Power Private Limited C-103 floor sec-2 Noida UP 201301	9910116446	rupal.gupta@orianapower.com	NA
6	Uneecops	Mr Anurag Jain	Director	6th Floor, Q Tower, A-8, Block A, Sector 68, Noida, Uttar Pradesh 201301	88876 63137	tyagi@uneecops.com8 4	NA
7	Innodust	Mr S K Sahoo	Director	PLOT NO.-A/63/1,SAHEED NAGAR BHUBANESWAR 751007	78944L2585	sunil.innodust@gmail.com	NA

8	Solar Tech Saarthi	Mr Lucky Aggarwal	MD	A-6/49. Sector 17. Rohini, Delhi 110089	9711851306	lucky.solarsaar	NA
9	Antriksh photonergy	YK JAIN	SMART ENERGY CONSULTANT	YK JAIN, SMART ENERGY CONSULTANT, ANTRIKSH PHOTONERGY, RZ-D1/100, FF, GALI NO 5, MAHAVIR ENCLAVE, NEW DELHI – 110045	91 9971539955	photonergy@outlook.com	NA
10	Solar Association	KAMAL MARWAH	Coordinator of the Association	C/o10B-E3 Shatabadi vihar sector-52 noida -201301	9958887092	kkmarwah@yahoo.co.in	NA

Annexure: Training & Employment Details

Training and Employment Projections:

Year	Total Candidates		Women		People with Disability	
	Estimated Training #	Estimated Employment Opportunities	Estimated Training #	Estimated Employment Opportunities	Estimated Training #	Estimated Employment Opportunities
2024-2025	300	25	50	5	25	5
2025-2026	350	25	50	5	25	5
2025-2027	350	25	50	5	25	5

Data to be provided year-wise for next 3 years

Training, Assessment, Certification, and Placement Data for previous versions of qualifications:

Qualification Version	Year	Total Candidates				Women				People with Disability			
		Trained	Assessed	Certified	Placed	Trained	Assessed	Certified	Placed	Trained	Assessed	Certified	Placed
NA	-	-	-	-	-	-	-	-	-	-	-	-	-
NA	-	-	-	-	-	-	-	-	-	-	-	-	-

Applicable for revised qualifications only, data to be provided year-wise for past 3 years.

List Schemes in which the previous version of Qualification was implemented:

1. NA

Content availability for previous versions of qualifications:

☒ Participant Handbook ☒ Facilitator Guide ☐ Digital Content ☐ Qualification Handbook ☐ Any Other:

Languages in which Content is available: English

Annexure: Blended Learning

Blended Learning Estimated Ratio & Recommended Tools:

Refer NCVET "Guidelines for Blended Learning for Vocational Education, Training & Skilling" available on:
https://ncvet.gov.in/sites/default/files/Guidelines%20for%20Blended%20Learning%20for%20Vocational%20Education,%20Training%20&%20Skilling.pdf

S. No.	Select the Components of the Qualification	List Recommended Tools – for all Selected Components	Offline : Online Ratio
1	☒Theory/ Lectures - Imparting theoretical and conceptual knowledge	NA	60:40
2	☒Imparting Soft Skills, Life Skills, and Employability Skills /Mentorship to Learners	NA	
3	☒Showing Practical Demonstrations to the learners		
4	☒Imparting Practical Hands-on Skills/ Lab Work/ workshop/ shop floor training		
5	☒Tutorials/ Assignments/ Drill/ Practice		
6	☒Proctored Monitoring/ Assessment/ Evaluation/ Examinations		
7	☒On the Job Training (OJT)/ Project Work Internship/ Apprenticeship Training		

Annexure: Detailed Assessment Criteria

Detailed assessment criteria for each NOS/Module are as follows:

NOS/Module Name	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
SGJ/N3105: Describe the basics of PV Cell, prepare & identify the bill of material and its specification	*Fundamental of PV cells*	36	25	-	-
	PC1. Analyse the role of the job holder, its importance in the solar PV manufacturing sector and the advantages of doing the course.				
	PC2. Show how crystal(mono and Poly crystalline) influence performance of solar cell	7	5		
	PC3. Show Solar Cell Manufacturing Process Flow Chart				
	PC4. Provide an overview of Solar PV Cell	7	5		
	PC5. Provide an overview of Machine Parts , Raw Material to Front Grid(FG) Cell	8	5	-	-
	Identification of Bill of Material and its specification	24	15	-	-
	PC6. Show and Identify various Materials, components and their application used in solar cell				
	PC7. Show how to prepare the BOM of Solar cell				
	PC8. Identify technical Specifications & uses, role/ importance in cell performance	8	5		
	NOS Total	60	40	-	-

NOS/Module Name	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	Chemical process	**20**	**21**	**-**	**-**
SGJ/N3104: Perform Solar cell manufacturing- Chemical Process	PC1. Discuss and show how to perform etching	**3**	**3**	**-**	**-**
	PC2. Show the bath change, make-up. techniques with hands on experience	**3**	**3**	**-**	**-**
	PC3. Explain Chemical process general requirement and types	**3**	**3**	**-**	**-**
	PC4. Discuss and Show the use of Chemical tools during the process	**3**	**3**	**-**	**-**
	PC5. Discuss the purposes of Chemical Process	**3**	**3**	**-**	**-**
	PC6. Explain Operation of the tools	**3**	**3**	**-**	**-**
	PC7. Explain and identify the defects and their criticality in the PV Cell	**2**	**3**	**-**	**-**
	Wetline techniques	**4**	**5**	**-**	**-**
	PC8. Discuss how to Avoid wrong practices during Chemical Process	**2**	**2**	**-**	**-**
	PC9. Identify the Statistical Process Control	**2**	**3**	**-**	**-**
	NOS Total	**24**	**26**	**-**	**-**

NOS/Module Name	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
SGJ/N3103: Perform Solar cell manufacturing-Thermal Process	*Thermal process*	**4**	**4**	**-**	**-**
	PC1. Discuss the flow chart of Diffusion and PECVD manufacturing process	**2**	**2**	**-**	**-**
	PC2. Analyse Machine Overview	**2**	**2**	**-**	**-**
	Function of various machine				
	PC3. Identify types of Chemical/Gas using for the process	**2**	**2**	**-**	**-**
	PC4. Show how to performbubbler change.	**2**	**4**	**-**	**-**
	Process Of PN Junction	**4**	**4**	**-**	**-**
	PC5. Show solar cell PN Junction	**4**	**4**	**-**	**-**
	process of Anti Reflection Coating (ARC)	**12**	**12**	**-**	**-**
	PC6. Show ARC Thickness & Refractive	**3**	**3**	**-**	**-**
	PC7. Show ARC Layer formation and depositionmethod	**3**	**3**	**-**	**-**
	PC8. Show graphite boat repair or assembly process				
	PC9. Show removal of defective broken cells from boat/tubes	**3**	**3**	**-**	**-**
	NOS Total	**24**	**26**	**-**	**-**

NOS/Module Name	Assessment Criteria for Outcomes	Theory	Practical	Project	Viva
SGJ/N3102: Perform Solar cell manufacturing- Metallization Process	*Metallization process*	**6**	**6**	-	-
	PC1. Show metallization process flow	**3**	**3**	-	-
	PC2. Show screen mountingtechnique	**3**	**3**	-	-
	Screen Printing	**6**	**6**	-	-
	PC3. Show how to perform Screen printing	**3**	**3**	-	-
	PC4. Identify important checkpoints in process control.	**3**	**3**	-	-
	Sun Simulator & EL test	**6**	**8**	-	-
	PC5. Show how to operate Halm	**2**	**3**	-	-
	PC6. Show how to perform IV/ EL test	**2**	**3**	-	-
	PC7. identify any dead and low power cells, short circuit cells, cracks, etc	**2**	**2**	-	-
	Visual Inspection	**6**	**6**	-	-
	PC8. Show how to perform the visual	**3**	**3**	-	-
	PC9. identify defects, Consequences of several process	**3**	**3**	-	-
	NOS Total	**24**	**26**	-	-

NOS/Module Name	Assessment Criteria for Outcomes	Theory	Practical	Project	Viva
SGJ/N3101: Perform packing of solar PV Cell	*Packing process*	**30**	**30**	**-**	**-**
	PC1. Explain and Show the Packing process and handling of Solar cell	**6**	**6**	**-**	**-**
	PC2. Identify processes where material and resources utilization can be optimized	**6**	**6**	**-**	**-**
	PC3. Show how to keep cell in to stacked in a box	**6**	**6**	**-**	**-**
	PC4. Discuss and Show how to pack cell in properly designed cartons for transportation	**6**	**6**	**-**	**-**
	PC5. Show the use of Fork lift machine for moving of solar cell pallet from one place to other	**6**	**6**	**-**	**-**
	monitoring of the assembly	**20**	**20**	**-**	**-**
	PC6. Discuss and Show how to visually inspect the completed cell for quality of materials and workmanship	**6**	**10**	**-**	**-**
	PC7. Discuss and Show how to check proper packaging material for cell	**6**	**10**	**-**	**-**
	PC8. Discuss the uses of separators	**8**	**-**	**-**	**-**
	NOS Total	**50**	**50**	**-**	**-**

NOS/Module Name	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
DGT/VSQ/N0102: Employability Skills (60 Hours)	*Introduction to Employability Skills*	1	1	-	-
	PC1. identify employability skills required for jobs in various industries	-	-	-	-
	PC2. identify and explore learning and employability portals	-	-	-	-
	Constitutional values – Citizenship	1	1	-	-
	PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
	PC4. follow environmentally sustainable practices	-	-	-	-
	Becoming a Professional in the 21st Century	2	4	-	-
	PC5. recognize the significance of 21st Century Skills for employment	-	-	-	-
	PC6. practice the 21st Century Skills such as Self- Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-	-
	Basic English Skills	2	3	-	-
	PC7. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-	-
	PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
	PC9. write short messages, notes, letters, e-mails etc. in English	-	-	-	-
	Career Development & Goal Setting	1	2	-	-

NOS/Module Name	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	PC10. understand the difference between job and career	-	-	-	-
	PC11. prepare a career development plan with short- and long-term goals, based on aptitude	-	-	-	-
	Communication Skills	2	2	-	-
	PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings	-	-	-	-
	PC13. work collaboratively with others in a team	-	-	-	-
	Diversity & Inclusion	1	2	-	-
	PC14. communicate and behave appropriately with all genders and PwD	-	-	-	-
	PC15. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-	-
	Financial and Legal Literacy	2	3	-	-
	PC16. select financial institutions, products and services as per requirement	-	-	-	-
	PC17. carry out offline and online financial transactions, safely and securely	-	-	-	-
	PC18. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
	PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
	Essential Digital Skills	3	4	-	-
	PC20. operate digital devices and carry out basic internet operations securely and safely	-	-	-	-
	PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively	-	-	-	-
	PC22. use basic features of word processor, spreadsheets, and presentations	-	-	-	-

NOS/Module Name	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	Entrepreneurship	2	3	-	-
	PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-	-
	PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
	PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
	Customer Service	1	2	-	-
	PC26. identify different types of customers	-	-	-	-
	PC27. identify and respond to customer requests and needs in a professional manner.	-	-	-	-
	PC28. follow appropriate hygiene and grooming standards	-	-	-	-
	Getting ready for apprenticeship & Jobs	2	3	-	-
	PC29. create a professional Curriculum vitae (Résumé)	-	-	-	-
	PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
	PC31. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
	PC32. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-

	PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
	NOS Total	20	30	-	-

SGJ/N0147: Maintain personal health & safety in a manufacturing facility	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	Establish and Follow safe work procedure	4	3	-	-
	PC1. identify corporate policies required for workplace safety	1	1	-	-
	PC2. identify requirements for safe work area and create a safe work environment	2	1	-	-
	PC3. identify contact person when workplace safety policies are violated	1	-	-	-
	PC4. provide information about incident/violation	1	-	-	-
	PC5. identify the location of first aid materials and administer first aid	1	1	-	-
	Use and maintain personal protective equipment	7	11	-	-
	PC6. identify the personal protection equipment required for specific locations on-site	3	5	-	-
	PC7. identify expiry dates and wear & tear issues of specified equipment	1	1	-	-
	PC8. demonstrate safe and accepted practices for personal protection	3	5	-	-
	Identify and mitigate safety hazards	7	6	-	-
	PC9. identify environmental hazards associated with the manufacturing facility	2	2	-	-
	PC10. identify electrical hazards	2	2	-	-
	PC11. identify personal safety hazards or work site hazards and mitigate hazards	3	1	-	-
	Demonstrate safe and proper use of required tools and equipment	6	6	-	-
	PC12. select tools, equipment and testing devices needed to carry out the work	2	2	-	-
	PC13. demonstrate safe and proper use of required tools and equipment	2	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC14. Explain occupational health & safety standards and regulations for cell manufacturing process.	1	-	-	-
PC15. Explain and demonstrate good housekeeping practices and infection control guidelines	1	1	-	-
PC16. Demonstrate how to Dispose- off any waste materials in accordance with safe working practices and procedures	-	1	-	-
NOS Total	24	26	-	-

Annexure: Assessment Strategy

This section includes the processes involved in identifying, gathering, and interpreting information to evaluate the Candidate on the required competencies of the program.

1. Assessment System Overview:

- Batches assigned to the assessment agencies for conducting the assessment on SDSM/SIP or email
- Assessment agencies send the assessment confirmation to VTP/TC looping SSC
- Assessment agency deploys the ToA certified Assessor for executing the assessment
- SSC monitors the assessment process & records

2. Testing Environment:

- Confirm that the centre is available at the same address as mentioned on SDMS or SIP
- Check the duration of the training.
- Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
- Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
- Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
- Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
- Check the availability of the Lab Equipment for the particular Job Role.

3. Assessment Quality Assurance levels / Framework:

- Question papers created by the Subject Matter Experts (SME)
- Question papers created by the SME verified by the other subject Matter Experts
- Questions are mapped with NOS and PC
- Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management

- Assessor must be ToA certified & trainer must be ToT Certified
- Assessment agency must follow the assessment guidelines to conduct the assessment

4. Types of evidence or evidence-gathering protocol:

- Time-stamped & geotagged reporting of the assessor from assessment location
- Center photographs with signboards and scheme specific branding
- Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
- Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos

5. Method of verification or validation:

- Surprise visit to the assessment location
- Random audit of the batch
- Random audit of any candidate

6. Method for assessment documentation, archiving, and access

- Hard copies of the documents are stored
- Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage
- Soft copies of the documents & photographs of the assessment are stored in the Hard Drives

On the Job:

OJT Monitoring Report

- As in Green Jobs Sector, reproducing the evidence for assessment is not feasible due to constraints like cost, confidentiality and controlled environment, every
- apprentice is required to record the evidences performed during the OJT and the same gets authorized by his/her supervisor.
- The evidence recording is done in a structured monitoring report, termed as OJT Monitoring report.
- During the OJT, every trainee is required to fill the OJT monitoring report which is required to be signed by his/her supervisor.
- Towards the end of OJT period these reports are submitted with the HR department of company
    - These duly submitted reports are then verified by an Industry nominated assessor for verification of evidence.

Theory, Practical & Viva:

- Scope – Is used to test the knowledge and understanding and skills acquired during the OJT as well as to conform the OJT monitoring report.

- Some personality traits and generic skills (such as – promptness, sharpness, communication skills, depth of knowledge, comprehension, presentation, patience
- etc) can also be tested, which is also required for the QP.
- Tools – The assessment's questions should be aligned with the Qualification Pack, covering the PCs. There will be summative assessment at the end of the OJT.
- Method – Direct questions open and close ended questions, situation-based questions, analytical questions, and decision-making based questions for Viva,
- MCQ for the theory and performing QP related operations for practical. Different questions in theory, practical and viva are included to test relevant PCs from
- the QP
- Analysis – Assessor draws a spectrum of ready answers to be expected from trainee for Viva. This reduces effect of subjectivity of the assessor. Comparative
- quality of trainees within a batch or different institutes can be gauged. The skill is gauged by observing the practical work.

Execution of OJT Assessment:

- HR department hands over the individual OJT monitoring report with Industry nominated assessor and schedules an assessment meeting for each trainee.
- Industry nominated assessor assesses each trainee based on OJT monitoring report, viva on each PC and also takes into account attendance of each trainee towards the end of the OJT period.
- The OJT marks are compiled for each NOS by the Industry nominated assessor and submitted with HR department of company.
- The OJT assessment results are then sent to SCGJ by HR department of company in a sealed envelope for compiling the assessment results in case of offline assessment.

Annexure: Acronym and Glossary

Acronym

Acronym	Description
AA	Assessment Agency
AB	Awarding Body
ISCO	International Standard Classification of Occupations
NCO	National Classification of Occupations
NCrF	National Credit Framework
NOS	National Occupational Standard(s)
NQR	National Qualification Register
NSQF	National Skills Qualifications Framework
OJT	On the Job Training

Glossary

Term	Description
National Occupational Standards (NOS)	NOS define the measurable performance outcomes required from an individual engaged in a particular task. They list down what an individual performing that task should know and also do.
Qualification	A formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards
Qualification File	A Qualification File is a template designed to capture necessary information of a Qualification from the perspective of NSQF compliance. The Qualification File will be normally submitted by the awarding body for the qualification.
Sector	A grouping of professional activities on the basis of their main economic function, product, service or technology.
Long Term Training	Long-term skilling means any vocational training program undertaken for a year and above. https://ncvet.gov.in/sites/default/files/NCVET.pdf

Annexure: Career Progression and OM

NSQF Level/domain	Solar- PV- Manufacturing									
8	MD/Director									
6.5-7	Production Head									
5.5-6	Quality Assurance Manager	Production Manager/Solar Manufacturing Entrepreneur								
4.5-5	Quality Assurance Engineer	Production Supervisor								
3.5-4	Quality Assurance Assistant	Solar PV Manufacturing Technician/ Operator	CNC Technician	Solar PV Electrical Maintenance Technician-	Solar PV Mechanical Maintenance Technician	Solar soldering technician	Solar PV Cell Manufacturing Technician	Solar lamination technician	Solar cell tester	Solar packer
2.5-3				Instrumentation Assistant					Testing technical assistant	
2	Solar PV Project Helper				Solar PV Project Helper	Solar PV Project Helper	Solar PV Project Helper	Solar PV Project Helper		Solar PV Project Helper
1										