



COMPETENCY STANDARD

Solar Electrical System Installation and Maintenance

Level: 2

(Light Engineering Sector)

Competency Standard Code: CS-LE-SESIM-L2-EN-V1



**National Skills Development Authority
Chief Advisor's Office
Government of the People's Republic of Bangladesh**

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This Competency Standard for Solar Electrical System Installation and Maintenance is a document for the development of curricula, teaching and learning materials, and assessment tools. It also serves as the document for providing training consistent with the requirements of industry in order to meet the qualification of individuals who graduated through the established standard via competency-based assessment for a relevant job.

This document has been validated by NSDA in association with Light Engineering Sector, industry representatives, academia, related specialist, trainer and related employee.

Public and private institutions may use the information contained in this standard for activities benefitting Bangladesh.

Introduction

The NSDA aims to enhance an individual's employability by certifying completeness with skills. NSDA works to expand the skilling capacity of identified public and private training providers qualitatively and quantitatively. It also aims to establish and operationalize a responsive skills ecosystem and delivery mechanism through a combination of well-defined set of mechanisms and necessary technical supports.

Key priority economic growth sectors identified by the government have been targeted by NSDA to improve current job skills along with existing workforce to ensure required skills to industry standards. Training providers are encouraged and supported to work with industry to address identified skills and knowledge to enable industry growth and increased employment through the provision of market responsive inclusive skills training program. " **Solar Electrical System Installation and Maintenance** " is selected as one of the priority occupations of Construction Sector. This standard is developed to adopt a demand driven approach to training with effective inputs from Industry Skills Councils (ISC's), employer associations and employers.

To support this effort, technical assistance has been provided by GIZ through its Skills Development for Sustainable Energy Solutions (Skills4SE) project, which focuses on strengthening the training ecosystem for grid connected renewable energy and energy efficiency. Skills4SE works closely with NSDA, training institutions, and industry stakeholders to enhance CS & CAD, develop curricula, and provide capacity-building support for trainers and assessors in line with industry demands. Additionally, GIZ is going to support the piloting of training programs to ensure effective implementation and industry alignment.

Generally, a competency standard informs curriculum, learning materials, assessment and certification of trainees enrolled in Skills Training. Trainees who successfully pass the assessment will receive a qualification in the Bangladesh National Qualification Framework (BNQF) and will be listed on the NSDA's online portal.

This competency standard is developed to improve skills and knowledge in accordance with the job roles, duties and tasks of the occupation and ensure that the required skills and knowledge are aligned to industry requirements. A series of stakeholder consultations, workshops were held to develop this document.

The document also details the format, sequencing, wording and layout of the Competency Standard for an occupation which is comprised of Units of Competence and its corresponding Elements.

Overview

A competency standard is a written specification of the knowledge, skills and attitudes required for the performance of an occupation, trade or job corresponding to the industry standard of performance required in the workplace.

The purpose of a competency standards is to:

- provide a consistent and reliable set of components for training, recognising and assessing people's skills, and may also have optional support materials
- enable industry recognised qualifications to be awarded through direct assessment of workplace competencies
- encourage the development and delivery of flexible training which suits individual and industry requirements
- encourage learning and assessment in a work-related environment which leads to verifiable workplace outcomes

Competency standards are developed by a working group comprised of representative from NSDA, Key Institutions, ISC, and industry experts to identify the competencies required of an occupation in Light Engineering Sector.

Competency standards describe the skills, knowledge and attitude needed to perform effectively in the workplace. CS acknowledge that people can achieve technical and vocational competency in many ways by emphasizing what the learner can do, not how or where they learned to do it.

With competency standards, training and assessment may be conducted at the workplace or at training institute or any combination of these.

Competency standards consist of a number of units of competency. A unit of competency describes a distinct work activity that would normally be undertaken by one person in accordance with industry standards.

Units of competency are documented in a standard format that comprises of:

- unit title
- nominal duration
- unit code
- unit descriptor
- elements and performance criteria
- variables and range statement
- curricular content guide
- assessment evidence guides

Together, all the parts of a unit of competency:

- describe a work activity
- guide the assessor to determine whether the candidate is competent or not yet competent

The ensuing sections of this document comprise of a description of the relevant occupation, trade or job with all the key components of a unit of competency, including:

- a chart with an overview of all Units of Competency for the relevant occupation, trade or job including the Unit Codes and the Unit of Competency titles and corresponding Elements
- the Competency Standard that includes the Unit of Competency, Unit Descriptor, Elements and Performance Criteria, Range of Variables, Curricular Content Guide and Assessment Evidence Guide.

**Competency Standards for National Skill Certificate, Level-2 in
Solar Electrical System Installation and Maintenance in Light Engineering Sector**

Level Descriptors of NSQF (BNQF 1-6)

Level & Job classification	Knowledge Domain	Skills Domain	Responsibility Domain
6-Mid-Level Manager/ Sub Assistant Engineer	Comprehensive actual and theoretical knowledge within a specific work or study area with an awareness of the validity and limits of that knowledge, able to analyse, compare, relate and evaluate.	Specialised and wider range of cognitive and practical skills required to provide leadership in the development of creative solutions to defined problems. Communicate professional issues and solutions to the team and to external partners/users.	Work under broad guidance and self-motivation to execute strategic and operational plan/s. Lead lower-level management. Diagnose and resolve problems within and among work groups.
5-Supervisor	Broad knowledge of the underlying, concepts, principles, and processes in a specific work or study area, able to scrutinize and break information into parts by identifying motives or causes.	Broad range of cognitive and practical skills required to generate solutions to specific problems in one or more work or study areas. Communicate practice-related problems and possible solutions to external partners.	Work under guidance of management and self-direction to resolve specific issues. Lead and take responsibility for the work and actions of group/team members. Bridge between management.
4-Highly Skilled Worker	Broader knowledge of the underlying, concepts, principles, and processes in a specific work or study area, able to solve problems to new situations by comparing and applying acquired knowledge.	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying the full range of methods, tools, materials and information. Communicate using technical terminology and IT technology with partners and users as per workplace requirements.	Work under minimal supervision in specific contexts in response to workplace requirements. Resolve technical issues in response to workplace requirements and lead/guide a team/ group.
3-Skilled Worker	Moderately broad knowledge in a specific work or study area, able to perceive ideas and abstract from drawing and design according to workplace requirements.	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools. Communicate with his team and limited external partners upholding the values, nature and culture of the workplace	Work or study under supervision with considerable autonomy. Participate in teams and responsible for group coordination.
2-Semi Skilled Worker	Basic understanding of underpinning knowledge in a specific work or study area, able to interpret and apply common occupational terms and instructions.	Skills required to carry out simple tasks, communicate with his team in the workplace presenting and discussing results of his work with required clarity.	Work or study under supervision in a structured context with limited scope of manipulation
1 –Basic Skilled Worker	Elementary understanding of ability to interpret the underpinning knowledge in a specific study area, able to interpret common occupational terms and instructions.	Specific Basic skills required to carry out simple tasks. Interpret occupational terms and present the results of own work within guided work environment/ under supervision.	Work under direct supervision in a structured context with limited range of responsibilities.

List of Abbreviations

CS	Competency Standard
ISC	Industry Skills Council
NSDA	National Skills Development Authority
BNQF	Bangladesh National Qualifications Framework
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SCVC	Standards and Curriculum Validation Committee
STP	Skills Training Provider
SOP	Standard Operating Procedure
UoC	Unit of Competency
ISO	International Organization for Standardization
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures

Approved by
40th Authority Meeting of NSDA
Held on 26 February 2025

Table of Contents

Copyright	i
Introduction	ii
Overview	iii
Level Descriptors of NSQF (BNQF 1-6)	iv
List of Abbreviations	v
Course Structure	1
Units & Elements at Glance	2
Generic Units of Competencies	4
Sector Specific Units of Competencies	8
Occupation Specific Units of Competencies	11
• OU-LE-SESIM-01-L2-V1: Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System	12
• OU-LE-SESIM-02-L2-V1: Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System	14
• OU-LE-SESIM-03-L2-V1: Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System	17
• OU-LE-SESIM-04-L1-V1: Use Hand and Power Tools in On-Grid, Hybrid and Solar Irrigation System	20
• OU-LE-SESIM-05-L2-V1: Install On-Grid, Hybrid and Solar Irrigation System	23
• OU-LE-SESIM-06-L2-V1: Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System	26
Development of Competency Standard	Error! Bookmark not defined.

**Competency Standards for National Skill Certificate, Level- 2, in
Solar Electrical System Installation and Maintenance in Light Engineering Sector**

Course Structure

SL No	Unit code and Title		UOC Level	Nominal (hours)
Generic Units of Competencies				
1.	GU-03-L2-V1	Carryout Workplace Interaction	2	15
2.	GU-04-L3-V1	Work in a Self-Directed Team	3	15
Sub Total				30
Sector Specific Units of Competencies				
Occupation Specific Units of Competencies				
1.	OU-LE-SESIM-01-L2-V1	Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System	2	20
2.	OU-LE-SESIM-02-L2-V1	Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System	2	20
3.	OU-LE-SESIM-03-L2-V1	Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System	2	40
4.	OU-LE-SESIM-04-L2-V1	Use Hand and Power Tools in On-Grid, Hybrid and Solar Irrigation System	2	30
5.	OU-LE-SESIM-05-L2-V1	Install On-Grid, Hybrid and Solar Irrigation System	2	100
6.	OU-LE-SESIM-06-L2-V1	Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System	2	60
Sub Total				240
Total Duration				270

Units & Elements at Glance

Generic Competencies

Code	Unit of competency	Elements of competency	Duration (hours)
GU-03-L2-V1	Carryout Workplace Interaction	1. Interpret workplace communication and etiquette 2. Read and understand workplace documents 3. Participate in workplace meetings and discussions 4. Practice professional ethics at workplace	15
GU-04-L3-V1	Work in a Self-Directed Team	1. Identify team goals and processes 2. Communicate and cooperate with team members 3. Work as a team member 4. Solve problems as a team member	15

Sector specific competencies

Occupation specific competencies

Code	Unit of competency	Elements of competency	Duration (hours)
OU-LE-SESIM-01-L2-V1	Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System	- Interpret On-grid/ grid tied System - Interpret hybrid System - Interpret solar irrigation system - Interpret energy storage system - Interpret grid connectivity and net-metering	20
OU-LE-SESIM-02-L2-V1	Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System	- Visit the site physically - Collect data as per requirement - Prepare report	20
OU-LE-SESIM-03-L2-V1	Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System	- Identify signs, symbols and specifications in the layout drawing - Interpret block diagram - Interpret SLD	40
OU-LE-SESIM-04-L2-V1	Use Hand and Power Tools in On-Grid, Hybrid and Solar Irrigation System	- Select hand tools and power tools - Practice to use hand tools and power tools - Maintain hand tools and power tools	50
OU-LE-SESIM -05-L2-V1	Install On-Grid, Hybrid and Solar Irrigation System	- Identify solar system components - Locate and prepare place - Handle components - Install Module Mounting Structure (MMS) - Install Solar Module. - Install Components	90
OU-LE-SESIM-06-L2-V1	Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System	- Prepare for work. - Perform routine maintenance - Diagnose faults in SES units and wiring - Repair the faults in SES unit and wiring - Clean and store tools and equipment	50

Generic Units of Competencies

Unit Code and Title	GU-03-L2-V1: Carryout Workplace Interaction
Unit Descriptor	This unit covers the knowledge, skills and attitude required to carry out workplace interaction. It specifically includes interpreting workplace communication and etiquette, reading and understanding workplace documents, participating in workplace meetings and discussions and practicing professional ethics at workplace.
Nominal Hours	15 Hours
Elements of Competency	Performance Criteria <u>Bold underlined</u> terms are elaborated in the Range of Variables
1. Interpret workplace communication and etiquette	1.1 Workplace code of conducts are interpreted as per organizational guidelines 1.2 Appropriate lines of communication are maintained with supervisors and colleagues 1.3 Workplace interactions are conducted in a <u>courteous manner</u> to gather and convey information 1.4 Questions about routine <u>workplace procedures and matters</u> are asked and responded as required
2. Read and understand workplace documents	2.1 Workplace documents are interpreted as per standard. 2.2 Assistance is taken to aid comprehension when required from peers / supervisors 2.3 Visual information / symbols / signage's are understood and followed 2.4 Specific and relevant information are accessed from <u>appropriate sources</u> 2.5 Appropriate medium is used to transfer information and ideas
3. Participate in workplace meetings and discussions	3.1 Team meetings are attended on time and meeting procedures and etiquette are followed 3.2 Own opinions are expressed and others opinions are listened without interruption 3.3 Inputs are provided consistent with meeting purpose and meeting outcomes are implemented
4. Practice professional ethics at workplace	4.1 Responsibilities as a team member are demonstrated and kept promises and commitments made to others 4.2 Tasks are performed in accordance with workplace procedures 4.3 Confidentiality is respected and maintained 4.4 Situations and actions considered inappropriate or which present a conflict of interest are avoided

Range of Variables	
Variable	Range (may include but not limited to):
1. Courteous manner	1.1 Effective questioning 1.2 Active listening 1.3 Speaking skills
2. Workplace procedures and matters	2.1 Notes 2.2 Agenda 2.3 Simple reports 2.3.1 Progress report 2.3.2 Incident report 2.4 Job sheets 2.5 Operational manuals 2.6 Brochures and promotional material 2.7 Visual and graphic materials 2.8 Standards 2.9 OSH information 2.10 Signs
3. Appropriate sources	3.1 HR Department 3.2 Managers 3.3 Supervisors
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspects of competency	1.1 Maintained workplace communication and etiquette 1.2 Followed workplace instructions and symbols 1.3 Followed team meeting and etiquette
2. Underpinning knowledge	2.1 Workplace communication and etiquette 2.2 Workplace documents, signs and symbols 2.3 Meeting procedure and etiquette
3. Underpinning skills	3.1 Maintaining workplace communication and etiquette 3.2 Following workplace instructions and symbols 3.3 Following team meeting and etiquette
4. Underpinning attitude	4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace

5. Resource implications	The following resources must be provided: 5.1 Work place Procedure 5.2 Materials relevant to the proposed activity 5.3 All tools, equipment, material and documentation required. 5.4 Relevant specifications or work instructions
6. Methods of assessment	Methods of assessment may include but not limited to: 6.1 Written test 6.2 Demonstration 6.3 Oral questioning 6.4 Portfolio
7. Context of assessment	7.1 Competency assessment must be done in a training center or in an actual or simulated work place after Completion of the training module 7.2 Assessment should be done by NSDA certified assessor
Accreditation Requirements Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any BNQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.	

Unit Code and Title	GU-04-L3-V1: Work in a Self-Directed Team
Nominal Hours	15 Hours
Unit Descriptor	This unit Covered the knowledge, skills and attitude to communicate and work within a team in an interactive work environment as per the workplace standard.
Elements of Competency	Performance Criteria Bold & Underlined terms are elaborated in the Range of Variables Training Components
1. Identify team goals and processes	1.1 <u>Team goals</u> and processes are identified. 1.2 Roles and responsibilities of team members are identified. 1.3 Relationships within team and with other work areas are identified.
2. Communicate and cooperate with team members	2.1. Effective interpersonal skills are used to interact with team members and to contribute to activities and objectives. 2.2. Formal and informal forms of communication are used effectively to support team achievement. 2.3. Diversity is respected and valued in team functioning. 2.4. Views and opinions of other team members are understood and reflected accurately. 2.5. <u>Workplace staff regulation</u> is used correctly to assist communication.
3. Work as a team member	3.1 Duties, responsibilities, authorities, objectives and task requirements are identified and clarified with team. 3.2 Tasks are performed in accordance with organizational and team requirements, specifications and workplace procedures. 3.3 Team members support other members as required to ensure team achieves goals and requirements. 3.4 Agreed reporting lines are followed using standard operating procedures.
4. Solve problems as a team member	4.1 Current and potential problems faced by team are identified. 4.2 Procedures for avoiding and managing problems are identified. 4.3 Problems are solved effectively and in a manner that supports the team.
Range of Variables	
Variable	Range (May include but not limited to)
1. Team goals and processes	1.1 Identifying the problem 1.2 Consider solutions 1.3 Action 1.4 Follow-up.

2. Workplace staff regulation	2.1 Organization / company's code of conduct, complaint handling / grievance policies and procedures
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment required evidence that the candidate: 1.1 communicated and worked within a team in an interactive work environment as per workplace standard. 1.2 dealt with a range of communication/ information at one time. 1.3 made constructive contributions in workplace issues 1.4 presented information clearly and effectively in written form 1.5 asked appropriate questions 1.6 provided accurate information
2. Underpinning knowledge	2.1 Organization requirements for written and electronic communication methods 2.2 Effective verbal communication methods
3. Underpinning skill	3.1 Organizing information 3.2 Understanding and conveying intended meaning 3.3 Participating in a variety of workplace discussions 3.4 Compiling with Organization's requirements in the use of written and electronic communication methods
4. Underpinning Attitudes	4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect for rights of peers and seniors in workplace 4.6 Communication with peers and seniors in workplace
5. Resource implication	5.1 Variety of Information 5.2 Communication tools 5.3 Simulated workplace
6. Methods of assessment	6.1 Written Test 6.2 Demonstration 6.3 Oral Questioning 6.4 Portfolio
2. Context of assessment	7.1 Competency assessment must be done in NSDA Accredited Assessment center 7.2 Assessment should be done by NSDA certified/ nominated assessor

Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any BNQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Sector Specific Units of Competencies

Occupation Specific Units of Competencies

Unit Code and Title	OU-LE-SESIM-01-L2-V1: Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to interpret On-grid, hybrid, solar irrigation and energy storage system It specifically includes – interpret On-grid/grid tied system, hybrid system, solar irrigation system, energy storage system and grid connectivity and net metering.
Nominal Hours	30 Hours
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables.
1. Interpret On-Grid/ Grid Tied System	1.1 On-grid system is interpreted. 1.2 On-grid system is identified. 1.3 Difference between On-grid and Off grid system is interpreted.
2. Interpret Hybrid System	2.1 Hybrid system is interpreted. 2.2 Hybrid system is identified. 2.3 Difference among the <u>systems</u> is interpreted.
3. Interpret solar irrigation system	3.1 Solar irrigation system is interpreted. 3.2 Solar irrigation system is identified.
4. Interpret energy storage system	4.1 Energy storage system is interpreted. 4.2 Energy storage system is identified.
5. Interpret Grid connectivity and Net Energy metering	5.1 Grid connectivity requirements are identified. 5.2 Net metering policy is interpreted. 5.3 Connections of net energy metering system is interpreted;
Range of Variables	
Variables	Range (may include but not limited to):
1. System	1.1 Off Grid, 1.2 On-Gid, 1.3 Hybrid, 1.4 Energy Storage system 1.5 Cleaning process and system
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.	

1. Critical aspects of competency	Assessment required evidence that the candidate: 1.1 Interpret On-grid/ grid tied System 1.2 Interpret hybrid System 1.3 Interpret solar irrigation system 1.4 Interpret energy storage system 1.5 Interpret grid connectivity and net-metering
2. Underpinning knowledge	2.1 On-grid/ grid tied System 2.2 Hybrid System 2.3 Solar irrigation system 2.4 Energy storage system 2.5 Grid connectivity and net-metering
3. Underpinning skills	3.1 Skills of identifying: 3.1.1 On-Grid/ Grid Tied System 3.1.2 Hybrid System 3.1.3 solar irrigation system 3.1.4 energy storage system 3.1.5 grid connectivity and net-metering
4. Underpinning attitudes	4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect for rights of peers and seniors in workplace
5. Resource implications	The following resources must be provided: 5.1. workplace (simulate or actual); 5.2. measuring tools, equipment and physical facilities appropriate to perform activities; 5.3. materials, consumables to perform activities; and 5.4. electrical drawings with SES layout.
6. Methods of assessment	6.1 Demonstration 6.2 Oral questioning 6.3 Written test
7. Context of assessment	7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor

Accreditation Requirements

Training Providers must be accredited by NSDA, the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Unit Code and Title	OU-LE-SESIM-02-L2-V1: Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System	
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude to prepare site assessment report for on-grid, hybrid and solar irrigation system. It specially includes the tasks -conduct site inspection and collect data, identify potential challenges and constraints and prepare and document site assessment report.	
Nominal Hours	20 Hours	
Elements of Competency	Performance Criteria <u>Bold & underlined</u> terms are elaborated in the Range of Variables	
1. Conduct site inspection and collect data	1.1 Site inspection is conducted following occupational safety and health standards. 1.2 Relevant <u>site data</u> is collected as required. 1.3 Site and Environmental conditions are verified and recorded. 1.4 Evacuation point is evaluated 1.5 Cable route is identified;	
2. Identify potential challenges and constraints	2.1 Potential shading issues and site-specific obstructions are identified; 2.2 Structural integrity of installation surfaces is evaluated. 2.3 Placement for components are identified; 2.4 Weather conditions and potential hazards are evaluated;	
3. Prepare and document the site assessment report	3.1. Site data is consolidated 3.2. Challenges, risks, and mitigation strategies are documented. 3.3. Site specific compliance are addressed. 3.4. Site assessment report including recommendations is prepared.	
Range of Variables		
Variable	Range (may include but not limited to):	
1. Site data	1.1 Available area 1.2 Sun light exposure facing (Azimuth) 1.3 Obstacles 1.4 Roof access and quality of roof 1.5 Water quality, level and demand for irrigation	
Evidence Guide		
The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.		

1. Critical aspects of competency	Assessment required evidences that the candidate: 1.1 Conduct site inspection and collect data 1.2 Identify potential challenges and constraints 1.3 Prepare and document the site assessment report
2. Underpinning knowledge	2.1 Site inspection technique 2.2 Relevant site data for inspection 2.3 Site and environment condition 2.4 Cable route
3. Underpinning skills	3.1 Skills of site inspection 3.2 Skills of collecting site data 3.3 Assessing of evacuation point 3.4 Selecting cable route
4. Required attitudes	4.1 Commitment to occupational safety and health. 4.2 Promptness in carrying out activities. 4.3 Sincere and honest to duties. 4.4 Eagerness to learn. 4.5 Tidiness and timeliness. 4.6 Environmental concerns. 4.7 Respect for rights of peers and seniors at workplace. 4.8 Communication with peers and seniors at workplace.
5. Resources implication	The following resources must be provided: 5.1 Workplace (actual or simulated) 5.2 Tools, equipment and physical facilities appropriate to perform activities. 5.3 Relevant drawings, manuals, codes, standards and reference materials.
6. Methods of assessment	Methods of assessment may include but not limited to: 6.1 written test 6.2 demonstration 6.3 oral questioning
7. Context for assessment	7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor

Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Unit Code and Title	OU-LE-SESIM-03-L2-V1: Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to interpret design, drawing and specifications for on-grid, hybrid and solar irrigation system It specifically includes – Identify signs, symbols and specifications in the layout drawings, interpret layout drawings and apply freehand sketching.
Nominal Hours	30 Hours
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables.
1. Identify signs, symbols and specifications in the layout drawing	1.1 <u>Layout drawing</u> of the selected work plan is collected; 1.2 Signs, symbols and specifications are identified. 1.3 Signs, symbols and specifications are checked against job requirement.
2. Interpret layout drawings	2.1 Layout drawing is interpreted. 2.2 Placement of <u>components</u> is identified in layout drawings. 2.3 Tools and equipment are identified, 2.4 <u>Components, assemblies and materials</u> are listed. 2.5 Dimensions of SES equipment with electrical accessories are identified. 2.6 Specifications are matched with available resources and job requirements.
3. Apply freehand sketching.	3.1 Freehand sketching is applied where applicable in accordance with the job requirements. 3.2 The drawing is adjusted to the specifications.
Range of Variables	
Variables	Range (may include but not limited to):
1. Layout drawings	1.1 PV module layout 1.2 Electrical single line diagram (SLD) 1.3 Solar mounting structure drawing
2. Components, assemblies and materials	2.1 PV Module 2.2 Charge controller 2.3 Battery 2.4 Inverter 2.5 Light fixtures 2.6 Switch board 2.7 Switch gear and protection equipment

	2.7.1 Surge Protector 2.7.2 Lighting arrester 2.7.3 Earthing 2.7.4 DC switch 2.7.5 DC breaker /Fuse 2.8 Electrical combiner boxes 2.9 Battery Rack 2.10 Pump Controller 2.11 Pump 2.12 Electrical cables and wires 2.9.1 DC cable 2.9.2 AC cable 2.9.3 Communication cable
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment required evidence that the candidate: 1.1 identified signs, symbols and specification in the drawing; 1.2 listed components, assemblies and materials in the drawing; 1.3 matched specifications with available resources and job requirements.
2. Underpinning knowledge	2.1 Interpretation of drawing. 2.2 Standard symbols in drawing. 2.3 Symbols and abbreviations used in electrical 2.4 Mechanical drawing. 2.5 Production of perpendicular and horizontal straight lines. 2.6 Linear measurement. 2.7 Dimension. 2.8 Unit conversion. 2.9 Performance standard as per workplace standards.
3. Underpinning skills	3.1 Comprehending blueprint reading. 3.2 Identifying of symbols and abbreviations. 3.3 Selecting of fixing materials. 3.4 Using of fixing tools, spirit level and T-square. 3.5 Listing the usages of tools, accessories, equipment, components, assemblies and material
4. Underpinning attitudes	4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect for rights of peers and seniors in workplace

5. Resource implications	The following resources must be provided: 5.1. workplace (simulate or actual); 5.2. measuring tools, equipment and physical facilities appropriate to perform activities; 5.3. materials, consumables to perform activities; and 5.4. electrical drawings with SES layout.
6. Methods of assessment	6.1 Demonstration 6.2 Oral questioning 6.3 Written test 6.4 Portfolio
7. Context of assessment	7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor
Accreditation Requirements Training Providers must be accredited by NSDA, the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.	

Unit Code and Title	OU-LE-SESIM-04-L1-V1: Use Hand Tools and Power Tools in On-Grid, Hybrid and Solar Irrigation System
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to use hand and power tools in on-grid, hybrid and solar irrigation system It specifically includes - select hand tools and power tools, practice to use hand tools and power tools and maintain hand tools and power tools
Nominal Hours	30 Hours
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables.
1. Select hand tools and power tools	1.1 Appropriate <u>hand tools and power tools</u> are selected as per requirement of the <u>task</u> . 1.2 Usages of hand and power tools are interpreted. 1.3 Unsafe or defective hand and power tools are identified and marked
2. Practice to use hand tools and power tools	2.1 Hand tools and power tools are used to perform the job as per specification. 2.2 Safe work practices are followed while using hand tools and power tools in the work environment. 2.3 Proper mind and body concentration is maintained during work.
3. Maintain hand tools and power tools	3.1 <u>Routine maintenance</u> of hand tools and power tools is undertaken according to standard operating procedures 3.2 Hand tools and power tools are stored in designated location in accordance with SOP of the company 3.3 Workplace is cleaned and waste are disposed as per workplace standards.
Range of Variables	
Variables	Range (may include but not limited to):
1. Hand tools	1.1 Screw drivers 1.2 Diagonal cutting pliers 1.3 Cable cutter 1.4 Long nose pliers 1.5 Combination pliers 1.6 Adjustable wrenches 1.7 Socket wrench set 1.8 Torque wrench 1.9 Hand punch 1.10 Neon tester 1.11 Battery tester

	1.12 Allen key 1.13 Ferrule printer/ punch 1.14 Crimping tool 1.15 Spanner set 1.16 Touch light 1.17 Electrician knife
2. Power tools	2.1 Hydraulic punch 2.2 Cordless drill machine 2.3 Electric hammer drill 2.4 Heat gun 2.5 Impact wrench 2.6 Grinding machine
3. Task	3.1 Adjusting 3.2 Assembling 3.3 Straightening / flattening 3.4 Finishing items or components 3.5 Clamping 3.6 Marking and tagging
4. Routine maintenance	4.1 Cleaning 4.2 Lubricating 4.3 Tightening 4.4 Calibration and tuning
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment required evidence that the candidate: 1.1 Selected hand tools and power tools 1.2 Practiced to use hand tools and power tools 1.3 Maintained hand tools and power tools
2. Underpinning knowledge	2.1 Uses of hand tools and power tools 2.2 Distinguish between hand tools and power tools 2.3 Proper utilization technique of hand and power tools. 2.4 Specification, types and use of hand tools and power tools. 2.5 Principles and techniques of maintenance and care of tools
3. Underpinning skills	3.1 Selecting hand tools and power tools. 3.2 Following safe practices for handling of tools and materials. 3.3 Performing maintenances of hand and power tools. 3.4 Maintaining and storing the tools.

4. Underpinning attitudes	4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect for rights of peers and seniors in workplace
5. Resource implications	5.1. Pens 5.2. Telephone 5.3. Computer 5.4. Writing materials 5.5. Online communication
6. Methods of assessment	6.1 Workplace observation 6.2 Demonstration 6.3 Oral questioning 6.4 Written test 6.5 Portfolio
7. Context of assessment	7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor
Accreditation Requirements Training Providers must be accredited by NSDA, the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.	

Unit Code and Title	OU-LE-SESIM-05-L2-V1: Install On-Grid, Hybrid and Solar Irrigation System
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude required to install on-grid, hybrid and solar irrigation system. It specifically includes the tasks of identifying SES components, locating and preparing place, handling components, installing mounting structures, the solar panel and components
Nominal Hours	50 Hours
Elements of Competency	Performance Criteria <u>Bold & underlined</u> terms are elaborated in the Range of Variables
1. Identify solar system components	1.1 Personal protective equipment (PPE) is used 1.2 Special rope, safety belts and ladder are used while working on roof. 1.3 <u>Solar system components</u> are identified and collected.
2. Locate and prepare place	2.1 Appropriate place with maximum sunlight exposure for mounting solar module. 2.2 Obstacle against the sunlight is identified and taken into consideration.
3. Handle components	3.1 Components are collected as per requirement 3.2 Components are handled as per standard
4. Install Module Mounting Structures	4.1 Module Mounting Structure is selected and collected 4.2 <u>Module Mounting Structure</u> is erected with required tilt angle; 4.3 Base of MMS is measured and construction condition is checked as per standard;
5. Install the PV module	5.1 PV modules is selected and collected 5.2 PV modules are fixed with MMS as per standard;
6. Install Components	6.1 Components are selected and collected 6.2 Components are installed as per standard
Range of Variables	
Variable	Range (may include but not limited to):
1. Solar system components	1.1 PV Module 1.2 Module Mounting Structure (MMS) 1.3 Inverter (On-Grid, Hybrid) 1.4 Charge Controller (Hybrid system) 1.5 Battery for hybrid system (Lead Acid, Li-ion, LiFePO ₄)

	1.6 Battery Rack 1.7 Cable (AC and DC) 1.8 Cable Conduit 1.9 Communication Cable 1.10 Online monitoring system 1.11 Pump for Solar irrigation system 1.12 Pump Controller for Solar irrigation system
2. Mounting Structure	2.1 Design of the mounting structure from 15 to 25 degree between the adjacent arms (As per sample). 2.2 Size of the mounting structure to be adjusted with the Solar Panel.
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspect of competency	Assessment required evidences that the candidate: 1.1 identified SES components 1.2 located and prepared place 1.3 Handled the PV modules and components 1.4 Installed the mounting structures 1.5 installed the PV modules and components
2. Underpinning knowledge	2.1 List the SES components 2.2 Use of SES components 2.3 Procedure of set PV module and components 2.4 Connection procedure of SES
3. Underpinning skills	3.1. Selecting SES components 3.2. Setting PV modules 3.3. Installing SES equipment and accessories.
4. Required attitudes	4.1 Commitment to occupational safety and health. 4.2 Promptness in carrying out activities. 4.3 Sincere and honest to duties. 4.4 Eagerness to learn. 4.5 Tidiness and timeliness. 4.6 Environmental concerns. 4.7 Respect for rights of peers and seniors at workplace. 4.8 Communicate with peers and seniors at workplace.
5. Resource implication	The following resources must be available: 5.1. workplace (actual or simulated) 5.2. Tools, equipment, materials and physical facilities appropriate to perform activities. 5.3. Relevant drawings, manuals, standards and reference materials. 5.4. Required PPEs.

6. Methods of assessment	Methods of assessment may include but not limited to: 6.1 written test 6.2 demonstration 6.3 oral questioning 6.4 portfolio
7. Context of assessment	7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor
Accreditation Requirements Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA	

Unit Code and Title	OU-LE-SESIM-06-L2-V1: Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System
Unit Descriptor	This unit of competency covers the knowledge, skills and attitude required to troubleshoot and maintain on-grid, hybrid and solar irrigation system. It specially includes the tasks of performing routine maintenance, diagnose faults in SES units and wiring and repaired the faults in SES unit and wiring.
Nominal Hours	50 Hours
Elements of Competency	Performance Criteria <u>Bold & underlined</u> terms are elaborated in the Range of Variables
1. Prepare for work.	1.1 Safe work environment is observed and corrective action is taken. 1.2 <u>Personal Protective Equipment (PPE)</u> is used as per job requirement. 1.3 Schedule for maintenance is collected and interpreted
2. Perform routine maintenance	2.1 PV module is cleaned as per schedule. 2.2 Quality of water for cleaning system is checked. 2.3 <u>Connection terminal</u> is checked as per schedule. 2.4 Inverter is cleaned as per schedule. 2.5 <u>Parameters of battery</u> are checked as per schedule, if battery is available in solar electrical system
3. Diagnose faults in SES units and wiring	3.1 <u>Physical faults</u> in the <u>major components</u> are checked visually. 3.2 <u>Operational faults</u> in the major components are checked by <u>testing instruments</u>. 3.3 Panel and string are tested for appropriate functioning. 3.4 Fault code is identified and reported to the supervisor
4. Repair the faults in SES unit and wiring	4.1 Battery water is added. 4.2 Loose connections are repaired throughout the wiring. 4.3 Faulty components are replaced as per supervisor instruction.
5. Clean and store tools and equipment	5.1 Tools and equipment are cleaned. 5.2 Tool, measuring instrument and excess materials are stored as per workplace procedure. 5.3 Wastages are disposed as per workplace requirement.
Range of Variables	
Variable	Range (may include but not limited to):

1. Personal Protective Equipment	1.1 Apron 1.2 Hand gloves 1.3 Face mask 1.4 Safety shoes 1.5 Goggles 1.6 Safety helmet 1.7 Harness
2. Connection terminal	2.1 Terminal connection of switches, sockets, light fixtures 2.2 Terminal connection of PV 2.3 Terminal connection of charge controller 2.4 Terminal connection of inverter 2.5 Terminal connection of battery 2.6 Switchgear and protection equipment incoming and outgoing points 2.7 Connection of solar motor
3. Parameters of battery	3.1 Water level 3.2 Specific gravity 3.3 Open circuit voltage
4. Physical faults	4.1 Broken PV module 4.2 Burnt components by high temperature 4.3 Damaged by insect 4.4 Disconnection developed by vibration 4.5 Lose connection 4.6 Battery terminal broken 4.7 Lose screw
5. Major components	5.1 Solar Module 5.2 Module Mounting Structure (MMS) 5.3 Inverter (On-Grid, Hybrid) 5.4 Charge Controller (Hybrid system) 5.5 Battery for hybrid system (Lead Acid, Li-ion, LiFePO4) 5.6 Battery Rack 5.7 Cable (AC and DC) 5.8 Cable Conduit 5.9 Communication Cable 5.10 Online monitoring system 5.11 Pump for Solar irrigation system 5.12 Pump Controller for Solar irrigation system
6. Operational faults	6.1 Components are inactive by aging 6.2 Components are inactive by transient effect 6.3 Components are inactive due to manufacturing defects 6.4 Components are inactive due to overload 6.5 Components are inactive due to short circuit

7. Testing instruments	7.1 Multimeter 7.2 LASER thermometer 7.3 Clamp on AVO meter (Analog, digital) 7.4 Hydrometer 7.5 Megger 7.6 Earth tester
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1 identified physical and operational faults; 1.2 tested panel for functioning; 1.3 identified faulty code; 1.4 checked parameters of battery and added water in battery; 1.5 tested components for functioning 1.6 tested motor and its components for functioning 1.7 replaced inactive and faulty components.
2. Underpinning knowledge	2.1 Function of each individual component of SES unit. 2.2 Checking procedure of connection terminal. 2.3 Battery parameter checking process. 2.4 Physical and operational faults of major components. 2.5 Testing process of Panel and string 2.6 Repairing or replacing technic of component or parts SES components. 2.7 Usages of testing instrument. 2.8 Electrical connections checking process. 2.9 Checking process of motor connection. 2.10 Motor pump and its parts.
3. Underpinning skills	3.1 Checking physical faults in the major components. 3.2 Checking operational faults in the major components 3.3 Testing panel and string. 3.4 Identifying fault code. 3.5 Checking electrolyte of the battery by hydrometer. 3.6 Checking battery for appropriate voltage. 3.7 Repairing and replacing of component of SES unit. 3.8 Cleaning of tools, equipment and workplace.

4. Required attitudes	4.1 Commitment to occupational safety and health. 4.2 Promptness in carrying out activities. 4.3 Sincere and honest to duties. 4.4 Eagerness to learn. 4.5 Tidiness and timeliness. 4.6 Environmental concerns. 4.7 Respect for rights of peers and seniors at workplace. 4.8 Communicate with peers and seniors at workplace.
5. Resource implication	The following resources must be available: 5.1 workplace (actual or simulated) 5.2 tools, equipment, materials and physical facilities appropriate to perform activities 5.3 relevant drawings, manuals and reference materials 5.4 required PPE.
6. Methods of assessment	Methods of assessment may include but not limited to: 6.1 written Test 6.2 demonstration 6.3 oral Questioning 6.4 portfolio
7. Context of assessment	7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor
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Development of Competency Standard

The Competency Standards for National Skills Certificate in Solar Electrical System Installation and Maintenance, Level-1 is reviewed and Level-2 & 3 is developed by NSDA with the assistance of GIZ on 14-16 and 22-23 January 2025.

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