COMPETENCY STANDARD

Solar Electrical System Installation and Maintenance

Level: 1

(Light Engineering Sector)

Competency Standard Code: CS-LE-SESIM-L1-EN-V1

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

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National Skills Development Authority
Prime Minister's Office
Level: 10-11, Biniyog Bhaban,
E-6 / B, Agargaon, Sher-E-Bangla Nagar Dhaka-1207, Bangladesh.
Email: ec@nsda.gov.bd
Website: www.nsda.gov.bd.
National Skills Portal: http:\\skillsportal.gov.bd

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-1 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

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Competency Standards for National Skill Certificate, Level- 1, 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-01-L2-V1	Perform Computations Using Basic Mathematical Concepts	2	15
2.	GU-02-L2-V1	Apply Occupational Safety and Health (OSH) Procedure in the Workplace	2	15
Sub Total				**30**
Sector Specific Units of Competencies				
Occupation Specific Units of Competencies				
3.	OU-LE-SESIM-01-L1-V1	Interpret the concept of climate change, renewable energy and solar electrical energy	1	20
4.	OU-LE-SESIM-02-L1-V1	Apply Basic Concepts of Electricity and Electrical Circuits	1	40
5.	OU-LE-SESIM-03-L1-V1	Estimate Load for Installation of Off-Grid System	1	20
6.	OU-LE-SESIM-04-L1-V1	Interpret Drawing and Specifications for Off-Grid System	1	50
7.	OU-LE-SESIM-05-L1-V1	Use Hand tools and Power Tools in Off-Grid System	1	30
8.	OU-LE-SESIM-06-L1-V1	Install Off-Grid SES and Solar Street Light	1	80
9.	OU-LE-SESIM-07-L1-V1	Perform Wiring for Off-Grid SES and Solar Street Light	1	50
10.	OU-LE-SESIM-08-L1-V1	Troubleshoot and Maintain of Off Grid Solar System	1	40
Sub Total				**330**
Total Duration				**360**

Units & Elements at Glance

Generic Competencies

Code	Unit of competency	Elements of competency	Duration (hours)
GU-01-L2-V1	Perform Computations Using Basic Mathematical Concepts	1. Identify calculation requirements in the workplace 2. Select appropriate mathematical methods for the calculation. 3. Use tool/instrument to perform calculations	15
GU-02-L2-V1	Apply Occupational Safety and Health (OSH) procedure In the Workplace	1. Identify OSH policies and procedures 2. Follow OSH procedure 3. Report hazards and risks 4. Respond to emergencies 5. Maintain personal well-being	15
		Total hours	**30**

Sector specific competencies

Occupation specific competencies

Code	Unit of competency	Elements of competency	Duration (hours)
OU-LE-SESIM-01-L1-V1	Interpret the Concept of Climate Change, Renewable Energy and Solar Energy	1. Interpret climate change and its impact. 2. Interpret the role of renewable energy in climate change 3. Interpret concept of Solar Electrical System (SES) 4. Identify workplace requirements in SES	20
OU-LE-SESIM-02-L1-V1	Apply Basic Concepts of Electricity and Electrical Circuits	1. Interpret the principle of electricity generation 2. Interpret electric parameters and measurement procedure 3. Interpret electric circuits 4. Perform electrical wiring. 5. Clean and store tools and equipment	40
OU-LE-SESIM-03-L1-V1	Estimate Load for Installation of Off-Grid System	1. Calculate electrical load 2. Perform measurement 3. Select off-grid system size	20
OU-LE-SESIM-04-L1-V1	Interpret Drawing and Specifications for Off-Grid System	1. Identify signs, symbols and specifications in the layout drawing 2. Interpret layout drawings 3. Apply freehand sketching.	50
OU-LE-SESIM-05-L1-V1	Use Hand tools and Power Tools in Off-Grid System	1. Select hand tools and power tools 2. Practice to use hand and power tools 3. Maintain hand and power tools	30
OU-LE-SESIM-06-L1-V1	Install Off-Grid SES and Solar Street Light	1. Identify SES components 2. Locate and prepare place 3. Handle components 4. Set the solar panel 5. Install components	80

OU-LE-SESIM-07-L1-V1	Perform Wiring for Off-Grid SES and Solar Street Light	1. Identify the route of conduits wiring. 2. Estimate the materials 3. Lay the conduit 4. Install wiring	50
OU-LE-SESIM-08-L1-V1	Maintain and Troubleshoot of Off Grid Solar System	1. Prepare for work. 2. Perform routine maintenance 3. Diagnose faults in SES units and wiring 4. Repair the faults in SES unit and wiring 5. Clean and store tools and equipment	50
		Total Hours	**330**

Generic Units of Competencies

Unit Code and Title	**GU-01-L2-V1: Perform Computations Using Basic Mathematical Concepts**
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude to perform computations using basic mathematical concepts in the workplace. It specifically includes the tasks of identifying calculation requirements in the workplace, selecting appropriate mathematical methods for the calculation and using appropriate tools/instruments to perform calculation.
Nominal Hours	**15 Hours**
Elements of Competency	**Performance Criteria** **Bold & Underlined** terms are elaborated in the Range of Variables Training Components
1. Identify calculation requirements in the workplace	1.1 Job requirements are identified 1.2 **Measurements** are selected in accordance with job requirement 1.3 Calculation requirements are identified from **workplace information**
2. Select appropriate mathematical methods for the calculation.	2.1 Mathematical methods are identified 2.2 **Appropriate method** is selected to carry out the calculation r equirements 2.3 Tolerance and clearance limits are identified and adjusted according to the job requirements
3. Use tool/instrument to perform calculations	3.1 Work instructions are confirmed and applied to the job in hand 3.2 Materials to be measured are identified as per job specification 3.3 Appropriate **tool/ instrument** is selected based on materials to be measured
Range of Variables	
Variable	**Range** (may include but not limited to)
1. Measurements	1.1 Length 1.2 Width 1.3 Weight 1.4 Tolerance
2. workplace information	2.1 Job Order 2.2 Design 2.3 Working drawing 2.4 Verbal instructions 2.5 Written Instruction
3. Appropriate method	3.1 Addition 3.2 Subtraction 3.3 Division 3.4 Multiplication

	3.5 Conversion 3.6 Percentage and ratio calculation
4. Tool/ Instrument	4.1 Calculator 4.2 Scale 4.3 Measuring tape 4.4 Marker
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 calculation requirements from workplace information 1.2 selected appropriate method to carry out the calculation requirements 1.3 selected measurements 1.4 selected appropriate methods 1.5 used tools/instruments 1.6 added numbers 1.7 subtracted numbers 1.8 multiplied numbers. 1.9 divided numbers. 1.10 completed calculations using appropriate tools/instruments
2. Underpinning Knowledge	2.1. Numerical concept 2.2. Basic mathematical methods such as addition, subtraction, multiplication and division and percentage. 2.3. Mathematical language, symbols and terminology. 2.4. Measuring units
3. Underpinning Skills	3.1 Interpreting numerical concept 3.2 Interpreting mathematical methods such as addition, subtraction, multiplication and division and percentage. 3.3 Interpreting mathematical language, symbols and terminology 3.4 Interpret measuring units
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 Implications	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	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 NSDA accredited assessment center 7.2. Assessment should be done by an 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	**GU-02-L2-V1: Apply Occupational Safety and Health (OSH) Procedure in the Workplace**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to apply occupational safety and health (OSH) procedure in the workplace. It specifically includes the task of identifying OSH policies and procedures, following OSH procedure, reporting hazards and risks, responding to emergencies and maintaining personal well-being.
Nominal Hours	**15 Hours**
Elements of Competency	**Performance Criteria** **Bold & Underlined** terms are elaborated in the Range of Variables
1. Identify OSH policies and procedures	1.1. **OSH policies** and **safe operating procedures** are accessed and stated 1.2. **Safety signs and symbols** are identified and followed 1.3. Emergency response, evacuation procedures and other contingency measures are determined according to workplace requirements
2. Follow OSH procedure	2.1 **Personal protective equipment (PPE)** is selected and collected as required 2.2 Personal protective equipment (PPE) is correctly used in accordance with organization OSH procedures and practices 2.3 A clear and tidy workplace is maintained as per workplace standard 2.4 PPE is maintained to keep them operational and compliant with OSH regulations
3. Report hazards and risks	3.1 **Hazards** and risks are identified, assessed and controlled 3.2 Incidents arising from hazards and risks are reported to designated authority
4. Respond to emergencies	4.1 Alarms and warning devices are responded 4.2 Workplace **emergency procedures** are followed 4.3 **Contingency measures** during workplace accidents, fire and other emergencies are recognized and followed in accordance with organization procedures 4.4 First aid procedures are applied during emergency situations
5. Maintain personal well-being	5.1 OSH policies and procedures are adhered to OSH awareness programs are participated in as per workplace guidelines and procedures.

	5.2 Corrective actions are implemented to correct unsafe condition in the workplace 5.3 **"Fit to work" records** are updated and maintained according to workplace requirements
Range of Variables	
Variables	**Range** (may include but not limited to):
1. OSH policies	1.1. Bangladesh standards for OSH 1.2. Fire Safety Rules and Regulations 1.3. Code of Practice 1.4. Industry Guidelines
2. Safe operating procedures	2.1 Orientation on emergency exits, fire extinguishers, fire escape, etc. 2.2 Emergency procedures 2.3 First Aid procedures 2.4 Tagging procedures 2.5 Use of PPE 2.6 Safety procedures for hazardous substances
3. Safety signs and symbols	3.1 Direction signs (exit, emergency exit, etc.) 3.2 First aid signs 3.3 Danger Tags 3.4 Hazard signs 3.5 Safety tags 3.6 Warning signs
4. Personal Protective Equipment (PPE)	4.1 Gas Mask 4.2 Gloves 4.3 Safety boots 4.4 Face mask 4.5 Overalls 4.6 Goggles and safety glasses 4.7 Sun block 4.8 Chemical/Gas detectors
5. Hazards	5.1 Chemical hazards 5.2 Biological hazards 5.3 Physical Hazards 5.4 Mechanical and Electrical Hazard 5.5 Mental hazard 5.6 Ergonomic hazard
6. Emergency procedures	6.1 Fire fighting 6.2 Earthquake 6.3 Medical and first aid 6.4 Evacuation

7. Contingency measures	7.1 Evacuation 7.2 Isolation 7.1 Decontamination
8. "Fit to Work" records	8.1 Medical Certificate every year 8.2 Accident reports, if any 8.3 Eye vision certificate
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	Assessment required evidence that the candidate: 1.1 stated OSH policies and safe operating procedures 1.2 followed safety signs and symbols 1.3 used personal protective equipment (PPE) 1.4 maintained workplace clear and tidy 1.5 assessed and Controlled hazards 1.6 followed emergency procedures 1.7 followed contingency measures 1.8 implemented corrective actions
2. Underpinning knowledge	2.1 Define OSH 2.2 OSH Workplace Policies and Procedures 2.3 Work safety procedures 2.4 Emergency procedures 2.5 Hazard control procedure 2.6 Different types of hazards 2.7 PPE and there uses 2.8 Personal hygiene practices 2.9 OSH awareness
3. Underpinning skills	3.1 Accessing OSH policies 3.2 Using of PPE 3.3 Handling cleaning tools and equipment 3.4 Writing report 3.5 Responding to emergency procedures
4. Required attitude	4.1 Commitment to occupational health and safety 4.2 Sincere and honest to duties 4.3 Promptness in carrying out activities 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect of peers and seniors in workplace 4.8 Communicate with peers and seniors in workplace
5. Resource implications	5.1 Workplace or simulated workplace

	5.2 Equipment and outfits appropriate in applying safety measures 5.3 Tools, equipment, materials and documentation required 5.4 OSH Policies and Procedures
6. Methods of assessment	Competency should be assessed by: 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.

Sector Specific Units of Competencies

Occupation Specific Units of Ccompetencies

Unit Code and Title	**OU-LE-SESIM-01-L1-V1: Interpret the concept of climate change, renewable energy and solar electrical energy**
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude to interpret the concept of climate change, renewable energy and solar electrical energy. It specially includes the tasks -interpret climate change and its impact, the role of renewable energy in climate change, concept of solar electrical system (SES) and identify workplace requirements in solar electrical system (SES)
Nominal Hours	**20 Hours**
Elements of Competency	**Performance Criteria** **Bold & underlined** terms are elaborated in the Range of Variables
1. Interpret climate change and its impact.	1.1 Concept of climate change is interpreted 1.2 **Causes of climate change** are listed 1.3 Global warming issues are identified 1.4 **Adverse effect** of climate change is interpreted 1.5 Impact of climate change is interpreted
2. Interpret the role of renewable energy in climate change	2.1 **Renewable energy** sources are identified 2.2 Prospect of renewable energy is interpreted 2.3 Mitigation of climate change through renewable energy is comprehended
3. Interpret concept of Solar Electrical System (SES)	3.1. Solar electrical system is interpreted 3.2. Trends and **solar electrical technologies** relevant to SES is interpreted 3.3. Solar Electrical relevant policies and guidelines are identified and interpreted
4. Identify workplace requirements in SES	4.1 **Workplace requirements** are identified. 4.2 Roles and responsibilities of all personnel working in Solar Electrical System (SES) are interpreted 4.3 Work schedule in Solar Electrical System workplace is interpreted 4.4 Requirements of safety signs, symbols and banners in workplace is interpreted

Range of Variables	
Variable	**Range** (may include but not limited to):
1. Cause of climate change	1.1 Global warming due to CO_2 and other gas emission 1.2 Fuel burning 1.2.1 Solid Fuel 1.2.2 Liquid Fuel

	1.3 Deforestation 1.4 Green House Gas (GHG)
2. Adverse effect.	Adverse effect may include but are not limited to: 2.1 Cyclone 2.2 Flood/Tidal surges. 2.3 Drought. 2.4 Salinity. 2.5 Crop failure.
3. Renewable energy	3.1. Solar 3.2. Wind power 3.3. Biogas 3.4. Hydropower 3.5. Biofuel 3.6. Geothermal
4. Solar electrical technologies	4.1 On Grid technology 4.2 Off grid technologies
5. Workplace requirements	5.1 Timely attendance 5.2 Working in SES service as per company requirements 5.3 Maintaining daily working hours 5.4 Work in installation of solar home system, street light, off grid and hybrid system 5.5 Work in installation of solar pump, on grid and power plant system 5.6 Work in troubleshooting of SES

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	Assessment required evidences that the candidate: 1.1 Interpreted climate change and its impact. 1.2 Interpreted the role of renewable energy in climate change 1.3 Interpreted concept of Solar Electrical System (SES) 1.4 Identified workplace requirements in SES
2. Underpinning knowledge	2.1 Climate change concept and aspects 2.2 Causes of climate change 2.3 Effect of climate change 2.4 Recycling concept and need 2.5 Concept of Solar Electrical System (SES)
3. Underpinning skills	3.1 Collecting information on climate change 3.2 Collecting data on climate change 3.3 Following instruction on recycling. 3.4 Interpreting Solar Electrical System (SES)

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 6.4 portfolio
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

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Unit Code and Title	**OU-LE-SESIM-02-L1-V1: Apply Basic Concepts of Electricity and Electrical Circuits**
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude to apply basic concepts of electricity and electrical circuits. It specially includes the tasks - interpret the principle of electricity generation, electric parameters and measurement procedure, electric circuits and perform electrical wiring.
Nominal Hours	**40 Hours**
Elements of Competency	**Performance Criteria** **Bold & underlined** terms are elaborated in the Range of Variables
1. Interpret the principle of electricity generation	1.1 Occupational Safety and Health (OSH) standard for electrical works are interpreted 1.2 Electricity generation process by generator and solar panel is interpreted; 1.3 **Renewable and non-renewable energy** sources are identified; 1.4 Working principle of conversion of solar energy to electrical energy is interpreted; **1.5** Solar energy storage principle is interpreted;
2. Interpret electric parameters and measurement procedure	2.1 **Electrical conductor, semi-conductor and insulator** is identified. 2.2 Sources of electricity are interpreted 2.3 Nature of electricity is interpreted; 2.4 Difference between AC and DC is explained 2.5 **Electrical measuring units** are described. 2.6 Measurement of voltage, current and resistance with **measuring instrument** are demonstrated. 2.7 Power and energy of a particular load is explained.
3. Interpret electric circuits	3.1 Electrical circuit is explained. 3.2 Types electrical circuits are classified 3.3 Series, parallel and mixed circuit is interpreted. 3.4 **Parameters** of **electrical circuits** is calculated and measured;
4. Perform electrical wiring.	4.1 **PPE** is used and OSH is maintained 4.2 Connection of series circuit by two lamps controlled from a switch is performed using channel wiring; 4.3 Connection of parallel circuit by two lamps controlled from individual switch is performed using channel wiring

	4.4 Connection of series parallel circuit by three lamps from individual switches is performed using channel wiring 4.5 Connection of tube light is performed. 4.6 Connection of ceiling fan is performed.
5. Clean and store tools and equipment	5.1 Tools and equipment are cleaned and stored. 5.2 Workplace is cleaned and kept tidy as per work place requirement. 5.3 Wastages are disposed as per workplace and environmental standard and regulations;
Range of Variables	
Variable	**Range** (may include but not limited to):
1. Renewable and non-renewable energy	1.1 Renewable 1.1.1 Solar energy 1.1.2 Hydro energy 1.1.3 Wind energy 1.1.4 Bio energy 1.1.5 Nuclear energy 1.2 Non-renewable energy 1.2.1 Petroleum based energy 1.2.2 Coal based energy
2. Electrical conductor	2.1 Copper 2.2 Alumunium 2.3 Gold 2.4 Sliver 2.5 Brass 2.6 Water
3. Semiconductor	3.1 Charcoal 3.2 Carbon 3.3 Dilute sulfuric acid 3.4 Wet soil
4. Insulator	4.1 Cotton. 4.2 Dry wood. 4.3 Stone. 4.4 Porcelain. 4.5 Glass 4.6 Rubber. 4.7 Ebonite. 4.8 Plastic.
5. Electrical measuring units	5.1 Volt (V). 5.2 Ampere (A). 5.3 Watt (W). 5.4 Kilowatt hour (Kwh).

	5.5 Ohm
6. Measuring instruments	6.1 Wattmeter (Analog and Digital) 6.2 AVO meter/ Multimeter (Analog and Digital) 6.3 Clamp-on meter
7. Electrical parameters	7.1 Voltage 7.2 Current 7.3 Resistance 7.4 Power 7.5 Energy 7.6 Frequency
8. Electrical circuits	8.1 Series 8.2 Parallel 8.3 Mixed
9. PPE	9.1 Apron 9.2 Hand gloves 9.3 Face mask 9.4 Safety shoes 9.5 Goggles 9.6 Safety helmet
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. interpreted electricity generation process by generator and solar panel; 1.2. identified electrical conductor, semi-conductor and non-conductor; 1.3. demonstrated measurement of voltage, current and resistance; 1.4. calculated electrical properties of series, parallel and mixed circuits; and 1.5. performed electrical wiring.
2. Underpinning knowledge	2.1. Concept of electrical parameters and measuring units. 2.2. Sources of renewable and non-renewable sources of energy. 2.3. Principle of electricity generation for AC and DC system. 2.4. Difference between AC and DC system 2.5. Conversion principle of AC to DC system and vice-versa. 2.6. Usages of electrical measuring instruments. 2.7. Procedures of using electrical conductors, semi-conductors and non-conductors.

	2.8. Calculation procedure of electrical properties of series, parallel and mixed circuits.
3. Underpinning skills	3.1. Using hand tools. 3.2. Identifying electrical conductors. 3.3. Measuring voltage, current, power and energy. 3.4. Wiring series and parallel circuit. 3.5. Demonstrating series, parallel and mixed circuit. 3.6. Performing circuit connection using channel wiring
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 provided:: 5.1. workplace (simulate or actual); 5.2. electric generator (small size); 5.3. cables / wire and fixing accessories; 5.4. measuring instrument, tapes, equipment and physical facilities appropriate to perform activities; 5.5. materials, consumables to perform activities.
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-03-L1-V1: Estimate Load for Installation of Off-Grid System**
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude to estimate load for installation of off-grid system. It includes the tasks of calculating electrical load, identifying specific requirements, selecting off-grid system size and performing measurement
Nominal Hours	**20 Hours**
Elements of Competency	**Performance Criteria** **Bold & underlined** terms are elaborated in the Range of Variables
1. Calculate electrical load	1.1 **Customer requirements** are identified 1.2 Types of loads are identified 1.3 Total load is estimated as per requirement.
2. Identify specific requirements	2.1 Location of all components and accessories are identified as per standard; 2.2 Space for PV module is measured; 2.3 Length of cables is measured;
3. Select off-grid system size	3.1 Total requirement of components and accessories are estimated. 3.2 **Major components** are selected
4. Perform measurement	4.1 OSH is followed and **PPE** is used; 4.2 **Instruments** are selected to measure electrical quantities. 4.3 **Basic tests** are performed as per standard

Range of Variables	
Variable	**Range** (may include but not limited to):
1. Customer requirement	1.1 DC load 1.2 AC load 1.3 Working hour/ backup time 1.4 Special requirement for equipment 1.4.1 Panel size 1.4.2 Panel type 1.4.3 Battery size 1.4.4 Battery type 1.4.5 Inverter size and type
2. Major Component	2.1 PV Module 2.2 Battery 2.3 Charge controller 2.4 Load 2.5 Inverter and Converter

3. Personal Protective Equipment (PPE)	3.1 Apron 3.2 Hand gloves 3.3 Face mask 3.4 Safety shoes 3.5 Goggles 3.6 Safety helmet
4. Instruments	4.1 Multimeter 4.2 Wattmeter (analogue and digital) 4.3 Megger, 500v I 1000v (analogue and digital) 4.4 Earth tester
5. Basic test	5.1 Insulation resistance test 5.2 Polarity test 5.3 Continuity test 5.4 AC/ DC parameters 5.5 Earth resistance test

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	Assessment required evidences that the candidate: 1.1 identified customer requirement; 1.2 estimated total load and total requirements of materials and accessories; 1.3 identified and selected measuring instruments; 1.4 performed electrical measurement using appropriate instruments. 1.5 Performed basic tests
2. Underpinning knowledge	2.1 Relevant customer requirement for estimating load. 2.2 Usages of measuring instrument. 2.3 Measuring units. 2.4 Measurement procedure electrical parameter. 2.5 Procedure of load calculations and estimation of material for SES installation. 2.6 Electrical load and materials calculation process. 2.7 Test procedures of electrical quantities.
3. Underpinning skills	3.1 Calculating load and estimating materials. 3.2 Identifying specifications of SES components. 3.3 Selecting instruments to measure electrical quantities. 3.4 Measuring electrical parameters. 3.5 Performing basic tests;

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 (simulate or actual); 5.2 measuring instrument, tapes, equipment and physical facilities appropriate to perform activities; and 5.3 materials, consumables to perform activities
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 **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

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Unit Code and Title	**OU-LE-SESIM-04-L1-V1: Interpret Drawing and Specifications for Off-Grid System**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to interpret drawing and specifications for off-grid system. It specifically includes – Identify signs, symbols and specifications in the layout drawings, interpret layout drawings and apply freehand sketching.
Nominal Hours	**50 Hours**
Elements of Competency	**Performance Criteria** **Bold and Underlined** terms are elaborated in the Range of Variables.
1. Identify signs, symbols and specifications in the layout drawing	1.1 **Layout drawing** 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 Tools and equipment are identified, 2.3 **Components, assemblies and materials** are listed. 2.4 Dimensions of SES equipment with electrical accessories are identified. 2.5 Specifications are matched with available resources and job requirements.
3. Apply freehand layout 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 Electrical single line diagram (SLD) 1.2 Solar mounting structure drawing 1.3 Wiring diagram
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 AC and DC switches 2.7.5 Breakers /Fuses 2.8 Electrical combiner boxes 2.9 Electrical cables and wires 2.9.1 DC cable 2.9.2 AC 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 drawing. 2.4 Linear measurement. 2.5 Dimension. 2.6 Unit conversion. 2.7 Performance standard as per workplace standards.
3. Underpinning skills	3.1 Comprehending blueprint reading. 3.2 Identifying symbols and abbreviations. 3.3 Selecting fixing materials. 3.4 Using fixing tools and spirit level 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

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Unit Code and Title	**OU-LE-SESIM-05-L1-V1: Use Hand tools and Power Tools in Off-Grid System**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to use hand tools and power tools in off-grid system It specifically includes - select hand and power tools, practice to use hand and power tools and maintain hand and power tools
Nominal Hours	**30 Hours**
Elements of Competency	**Performance Criteria** **Bold and Underlined** terms are elaborated in the Range of Variables.
1. Select hand tools and power tools	1.1 Appropriate **hand tools and power tools** are selected as per requirement of the **task**. 1.2 Usages of hand tools 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 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 **Routine maintenance** 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 Hand punch 1.8 Neon tester 1.9 Allen key 1.10 Crimping tool 1.11 Touch light 1.12 Electrician knife

2. Power tools	2.1 Cordless impact drill 2.2 Electric hammer drill 2.3 Impact wrench
3. Task	3.1 Adjusting 3.2 Assembling 3.3 Straitening / 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 tunning
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 tools 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 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

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Unit Code and Title	**OU-LE-SESIM-06-L1-V1: Install Off-Grid SES and Solar Street Light**
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude required to install off-grid SES and solar street light. It specifically includes the tasks of identifying SES components, locating and preparing places, handling components, setting the PV modules and installing components
Nominal Hours	**80 Hours**
Elements of Competency	**Performance Criteria** **Bold & underlined** terms are elaborated in the Range of Variables
1. Identify SES components	1.1 Personal protective equipment (PPE) is used and OSH is followed; 1.2 Special rope, safety belts and ladder are used while working on roof; 1.3 **SES components** are identified and selected 1.4 Functionality of the components are ensured.
2. Locate and prepare places	2.1 **Appropriate place** with maximum sunlight exposure for panel setting located. 2.2 Obstacle against the sunlight is removed.
3. Handle components	3.1 Components are collected as per requirement 3.2 Components are handled as per standard
4. Set the PV modules	4.1 Erection of **Mounting Structure** with tilt angle within 15 to 25 degree is demonstrated. 4.2 Setting the panel within the mounting structure is demonstrated.
5. Install components	4.1 Charge controller is installed as per layout plan; 4.2 Battery is placed as per layout plan; 4.3 Inverter is placed on board as per layout plan; 4.4 Light fixtures are installed as per layout plan; 4.5 Electrical fittings and fixtures are installed as per layout plan.
Range of Variables	
Variable	**Range** (may include but not limited to):
1. SES components	1.1 PV Module 1.2 Charge controller 1.3 Battery 1.4 Inverter

	1.5 Cables (AC and DC) 1.6 Loads (If necessary) 1.7 Solar street light
2. Appropriate place	2.1 Roof top with maximum sunlight exposure 2.2 Additional place at the top of Pole near the house.
3. 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 PV module. 2.3 Mounting pole for solar street light
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 set the PV modules 1.4 installed components
2. Underpinning knowledge	2.1 List SES components 2.2 Use of SES components 2.3 Procedure of set PV modules 2.4 Connection procedure of SES
3. Underpinning skills	3.1. Selecting SES components 3.2. Setting PV module 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-07-L1-V1: Perform Wiring for Off-Grid SES and Solar Street Light**
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude required to perform wiring for off-grid SES and solar street light. It specially includes the tasks of identifying the route of conduits wiring, estimating the materials, laying the conduit and installing wiring
Nominal Hours	**50 Hours**
Elements of Competency	**Performance Criteria** **Bold & underlined** terms are elaborated in the Range of Variables
1. Identify the route of conduits wiring.	1.1. Plan or drawing is collected. 1.2. Wiring diagram of the electrical installation is collected. 1.3. Location of distribution boards (DB), sub distribution boards (SDB), light fixtures, ceiling fans, switches, sockets are identified as per drawing selected.
2. Estimate the materials	2.1 Distance of all SDB, Light, Fan, Switch and Socket from main distribution board is summed up. 2.2 Total quantity of the conduits and cables is estimated 2.3 Total numbers of DB, SDB, Light, Fan, Switch and Socket with specification are estimated. 2.4 Total quantity of **protective device** and **installation materials** are estimated.
3. Lay the conduit	3.1 **Hand tools, power tools** and **equipment** are identified. 3.2 Conduits on roof straight along the distance from DB to every SDB, Light, Fan, Socket are laid as applicable. 3.3 Conduits in the slots are laid.
4. Install wiring	4.1 Proper **personal protective equipment (PPE)** is used during performance of the works 4.2 Cables are pulled in every conduit as per specification. 4.3 Load are connected to operate with individual controlling device. 4.4 Circuit is tested by multi meter and power is supplied.
Range of Variables	
Variable	**Range** (may include but not limited to):
1. Protective device	1.1 FUSE 1.2 MCB 1.3 MCCB

2. Installation materials	2.1 PVC conduits, Junction boxes, bends, elbows. 2.2 PVC cables (4 rm, 2.5 rm, 1.5 rm and 1.5 re). 2.3 GI wire 2.4 Distribution boards. 2.5 Sub distribution boards. 2.6 Light fixtures. 2.7 Ceiling fans. 2.8 Switches. 2.9 Combined switch sockets. 2.10 Insulation tapes. 2.11 Rawl plugs and screws.
3. Hand tools	3.1 Screw drivers. 3.2 Diagonal cutting pliers. 3.3 Long nose pliers. 3.4 Combination pliers. 3.5 Electrician knife. 3.6 Neon tester. 3.7 Hack saw with blade.
4. Power tools	4.1. Electric hand drill machine with bits 4.2. Electric slot cutting machine with cutting disc.
5. Equipment	5.1 Multimeter 5.2 Clamp on meter 5.3 Spirit level. 5.4 Measuring tape 5.5 Protractor
6. Personal Protective Equipment (PPE)	6.1 Apron. 6.2 Hand gloves. 6.3 Mask. 6.4 Safety shoes. 6.5 Goggles. 6.6 Helmet
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 the route of conduits wiring. 1.2 estimated the materials 1.3 laid the conduit 1.4 installed wiring

2. Underpinning knowledge	2.1 Conduits wiring easy route selection technique; 2.2 Materials estimating procedure 2.3 Laid technique of conduit 2.4 Wiring installation process
3. Underpinning skills	3.1 Tracing out the connecting terminals of equipment. 3.2 Laying the PVC conduits. 3.3 Marking the cables/wires. 3.4 Drawing the cables in the conduits. 3.5 Using of hand tools for terminating cables and equipment
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

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Unit Code and Title	**OU-LE-SESIM-08-L1-V1: Troubleshoot and Maintain Off Grid Solar System**
Unit Descriptor	This unit of competency covers the knowledge, skills and attitude required to troubleshoot and maintain of off grid solar system. It specially includes the tasks of performing routine maintenance, diagnosing faults in SES units and wiring and repaired the faults in SES unit and wiring.
Nominal Hours	**40 Hours**
Elements of Competency	**Performance Criteria** **Bold & underlined** 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 **Personal Protective Equipment (PPE)** 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 **Connection terminal** is checked as per schedule. 2.4 Inverter is cleaned as per schedule. 2.5 **Parameters of battery** are checked as per schedule, if battery is available in Solar electrical system
3. Diagnose faults in SES units and wiring	3.1 **Physical faults** in the **major components** are checked visually. 3.2 **Operational faults** in the major components are checked by **testing instruments**. 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
2. Connection terminal	2.1 Terminal connection of switches, sockets, light fixtures and appliances 2.2 Terminal connection of PV module 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
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 PV module 5.2 Charge controller 5.3 Battery 5.4 Inverter
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
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;
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 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

Accreditation Requirements

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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.

List of Members

Sl No	Name and Address	Position in the committee
1.	Abu Hasnat Md. Jamil Islam; Deputy General Manager, Dana Power Company Ltd. Mobile 01716622357; Email: hasnat.jam@gmail.com;	Member
2.	Md. Akhteruzzaman Managing Director, Tradesol Limited. Mobile: 01712446934, Mail ID:md.akhteruzzaman86@gmail.com	Member
3.	Muntasir Al Khaledunnabi Expert, IDCOL Mobile: 01675022524, Email: muntasir.ak31@gmail.com	Member
4.	Md. Abdus Salam Consultant, Renewable Energy, DTCL Mobile: 01911270044, Email: abdusreb@gmail.com	Member
5.	Jahidul Islam Refat Engineer, Filament Engineering Ltd Mobile: 01901518691, Email: sales23.filament@gmail.com	Member
6.	Shyamal Kumar Mondal Assistant Engineer, Renewable Energy, G-Tech Solutions Ltd. Mobile: 01756136202, Email: shayamaleee44@gmail.com	Member
7.	Bishawjit Mitra Engineer, Filament Engineering Ltd. Mobile: 01979590228, Email: sales.filament15@gmail.com	Member
8.	Md. Shafi Mahmud Sarker Manager, Engineering and Maintenance (Environmental), Talisman Ltd. Mobile: 01711140123, Email: shafimahmudsarker@gmail.com	Member
9.	Riyadh-Bin-Shahid Manager, Technical, Renewable Energy, IDCOL Email: riyadh@idcol.org, Mobile: 01673000 999	Member
10.	Mushfiqur Rahman Manager, Renewable Energy, Safari Solar (Safari Trade International), Mobile: 0172 1740258 e-mail: mushfiqbd91@gmail.com	Member
11.	Md Abdur Razzaque, Expert (Curriculum), NSDA Mobile: 01742-734313, Email: razzaque159@gmail.com	Member