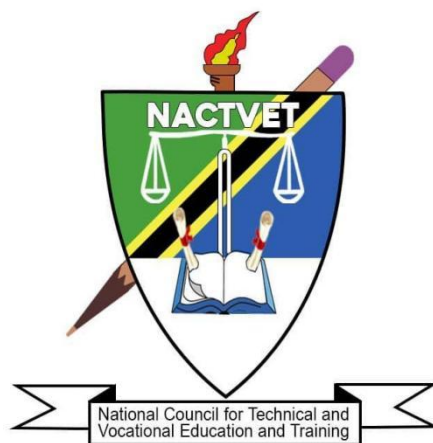


**NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND
TRAINING OF TANZANIA**



MAY 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)

LEVEL: NTA 5

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ABBREVIATIONS

6S	Standardized Management Mode for the Production Operation Site: Security, Seiketsu, Seiri, Seiso, Seiton and Shitsuke
AC	Alternating Current
APP	Application Program
BMS	Battery Management System
CAD	Computer Aided Design
CBET	Competency Based Education and Training
DC	Direct Current
MC4	Multi-Contact-4mm Photovoltaic Pin Connector
MPPT	Maximum Power Point Tracking
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
PF	Power Factor
PLC	Programmable Logic Controller
PV	Photovoltaic Power Generation
SVG	Static Var Generator
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross-cutting issues.
Competence:	The ability to use knowledge, understanding, practical and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks - essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as a performance tool of assessment of the prescribed outcomes.
Performance Criteria:	Indicate expected end results or outcome in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.
Standards:	A set of statements, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
Task Analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required of employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps that leads to a product, service, or decision.

**UNDERPINNING
KNOWLEDGE**

Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.

Verification process:

The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.

**Occupational
Competence:**

The application of knowledge and skills that consistently meet the standards required by the work context.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical Education has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupation Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current, and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training standards/qualifications standards are different. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical wiring circuits, performs troubleshooting in electrical wiring, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is however critical that there must be a direct link between the occupational standards and the training standards to respond to demands of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the occupational standards. Occupational standards are thus the starting point for developing

competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant occupational standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Renewable Energy Engineering Engineer (Solar) Occupation has its own set of occupational standards. The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARDS DEVELOPMENT PROCESS

The occupational standards development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTVET labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of expert workers and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as Appendix 1 to this document.

The occupational standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and stakeholder forums were used to validate the occupational standards. Engineers, Supervisory Technicians on the job, and experienced Renewable Energy Engineering Technicians (Solar) were key informants in the survey to discover occupational trends. This information was used to gain insight from the workplaces regarding occupational trends and changes, including how well graduates

are prepared for working in the occupation. A total of online surveys were completed by experts from the labour market across the country. Apart from the survey aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATIONAL STANDARDS FOR RENEWABLE ENERGY ENGINEERING TECHNICIANS (SOLAR)

These standards cover a broad range of duties and tasks that can be performed by a Renewable Energy Engineering Technician (Solar). However, the occupational standards are not meant to replace individual job descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Renewable Energy Engineering Technician (Solar) may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

Renewable Energy Engineering Technicians (Solar) refer to the personnel engaged in identification and review of the assembly drawings for the PV generation system and station power load and materials, installation and debugging of PV power station modules, monitoring devices and other related facilities and equipment, as well as inspection and maintenance of the operating status of the PV power station during the construction of the solar PV power station, and the following are the main responsibilities of a Renewable Energy Engineering Technician (Solar):

Generally, the Renewable Energy Engineering Technician (Solar) performs the following responsibilities:

- a) Equipment selection, material accounting, installation, operation, maintenance and hand-over of equipment for the small PV system
- b) Household PV construction scheme design, installation, inspection and maintenance
- c) Determination of routine use and maintenance methods for various PV generation systems
- d) Analysis and determination of the failure reasons of the PV generation system and disposal of common failures according to various fault phenomena

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA 4-6.

4.0. VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR) - NTA 5

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	INTERPRETATION OF HOUSEHOLD PV CONSTRUCTION DRAWINGS	DUTY NO.	501
TASK TITLE	INTERPRETATION OF CONSTRUCTION DRAWINGS OF PHOTOVOLTAIC POWER GENERATION SUBSYSTEM	TASK NO.	5011
PERFORMANCE CRITERIA	The person performing this task must be able to interpret construction drawings of photovoltaic power generation subsystem in accordance with the reading specifications and electrical graphic symbol standards.		
RANGE STATEMENT	The task can be performed on installation site of PV generation systems under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Data such as principle drawings, wiring drawings and installation drawings of photovoltaic power generation subsystem; 2. Computers (to check electronic drawings).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. View the catalog of drawings; 2. View general instructions; 3. View the general construction plan; 4. Interpret installation construction drawings of household grid-connection PV generation system; 5. Interpret installation construction drawings of AC/DC hybrid off-grid PV generation system; 6. Interpret installation construction drawings of complementary PV street lights.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 View construction drawings of photovoltaic power generation subsystem; 1.2 Interpret construction drawings of photovoltaic power generation subsystem. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Household grid-connection PV generation system; 2.2 AC/DC hybrid off-grid PV generation system; 2.3 Independent wind-solar street lights, complementary commercial power street lights and off-grid wind-solar power generation system; 2.4 Relevant standards of installation construction drawings. 3.0 Theories	

	The person performing this task must be able to explain the following contents: 3.1 Components of household grid-connection PV generation system and functions of all parts; 3.2 Functions of components and parts of AC/DC hybrid off-grid PV generation system; 3.3 Functions of components and parts of independent wind-solar street lights, complementary commercial power street lights and off-grid wind-solar power generation system. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Construction drawings of PV power generation subsystem are read in accordance with reading standards and specifications.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Reading standards and specifications of installation construction drawings of power generation system and power street lights; 2. Reading methods of installation construction drawings of power generation system and power street lights.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	INTERPRETATION OF HOUSEHOLD PV CONSTRUCTION DRAWINGS	DUTY NO.	501
TASK TITLE	INTERPRETATION OF CONSTRUCTION DRAWINGS OF ENERGY STORAGE SUBSYSTEM	TASK NO.	5012
PERFORMANCE CRITERIA	The person performing this task must be able to read construction drawings of energy storage subsystem in accordance with the reading specifications and electrical graphic symbol standards.		
RANGE STATEMENT	The task can be performed on installation site of PV generation systems under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Data such as principle drawings, wiring drawings and installation drawings of energy storage subsystem; 2. Computers (to check electronic drawings).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. View the list of drawings; 2. View general instructions; 3. View the general construction plan; 4. Interpret principle drawings of the household energy storage subsystem; 5. Interpret wiring drawings of the energy storage subsystem; 6. Interpret installation drawings of the energy storage subsystem.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Read construction drawings of the energy storage subsystem; 1.2 Interpret construction drawings of the energy storage subsystem. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Installation and operation principles of the energy storage subsystem; 2.2 Construction principles of installing energy storage subsystem: a battery consistency management and traceability system must be established to monitor battery performance parameters in real-time, conduct regular maintenance and safety assessments, and prepare emergency plans in accordance with the full lifecycle concept. 3.0 Theories The person performing this task must be able to explain the following contents:	

	3.1 Functions of energy storage subsystem; 3.2 Components of energy storage subsystem; 3.3 Functions of parts of energy storage subsystem. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Construction drawings of energy storage subsystem are read in accordance with reading standards and specifications.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Construction reading knowledge; 2. Safety protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	CONSTRUCTION SCHEME OF HOUSEHOLD PV	DUTY NO.	502
TASK TITLE	DETERMINATION OF THE INSTALLATION LOCATION, SUPPORT FOUNDATION METHOD, AND CABLE LAYING PLAN OF HOUSEHOLD GRID-CONNECTION PV GENERATION SYSTEM	TASK NO.	5021
PERFORMANCE CRITERIA	The person performing this task must be able to install the PV generation system in accordance with the technical requirements for PV system installation.		
RANGE STATEMENT	The task can be performed on installation site of PV generation systems under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. PV support; 2. PV module; 3. PV controller; 4. Inverter; 5. Battery; 6. Electric cabinet, electric meter, communication line, cable, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Complete the foundation construction of PV supports in accordance with the construction drawings; 2. Install all types of PV supports; 3. Install all types of PV modules; 4. Install PV controllers, inverters and batteries; 5. Install the PV generation system distribution cabinet and other auxiliary facilities.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Install PV supports made of galvanized steel, stainless steel, aluminum alloy and other materials on flat roof, terra-cotta tile roof, and color steel tile roof; 1.2 Install PV modules, controllers, inverters, batteries, distribution cabinets, communication and other equipment. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Installation angle of PV supports; 2.2 Controllers and inverters. 3.0 Theories The person performing this task must be able to explain the following contents:	

	3.1 Components of household grid-connection PV generation system and functions; 3.2 Functions and connection methods of PV modules; 3.3 Functions of PV controllers and inverters; 3.4 Functions of battery; 3.5 Functions of electric cabinets, electric meters and communication lines. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Related equipment of grid-connection PV generation system should be installed.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. General knowledge of data; 2. Safe operation of equipment installation; 3. User manual for relevant manufacturers.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	CONSTRUCTION AND INSTALLATION OF HOUSEHOLD PV SYSTEMS	DUTY NO.	503
TASK TITLE	COMPLETATION OF THE FOUNDATION CONSTRUCTION OF PV SUPPORTS IN ACCORDANCE WITH THE CONSTRUCTION DRAWINGS	TASK NO.	5031
PERFORMANCE CRITERIA	The person performing this task must be able to install PV supports in accordance with technical requirements, construction requirements, and construction schemes.		
RANGE STATEMENT	The task may be executed under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Electric welding machine; 2. Protractor; 3. Level ruler; 4. High pressure gloves; 5. Insulating shoes; 6. Safety helmet; 7. Crimping plier; 8. Wire stripper; 9. Impact drill; 10. Multimeter; 11. Clamp ammeter; 12. Electrical insulation test meter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Interpret installation construction drawings of household grid-connection PV generation system; 2. Interpret installation construction drawings of complementary PV street lights; 3. Perform material accounting; 4. Conduct on-site investigation; 5. Use an impact drill to drill holes in the wall; 6. Use an electric drill to drill holes on the metal support.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Read installation construction drawings; 1.2 Perform material accounting; 1.3 Conduct on-site investigation; 1.4 Conduct PV support construction. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Components of PV generation system;	

7. Use an angle grinder or a toothless saw to cut the metal support; 8. Perform rust removal of metal supports, painting, and installation of flat roof PV supports made of galvanized steel, stainless steel, aluminum alloy, and other materials.	2.2 Working principles of PV generation system. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Reading knowledge of installation construction drawings of power generation system; 3.2 Functions of each component and type selection knowledge. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Supports are installed in accordance with technical requirements and construction requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. General knowledge of machinery; 2. General knowledge of construction; 3. Safety protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	CONSTRUCTION AND INSTALLATION OF HOUSEHOLD PV SYSTEMS	DUTY NO.	503
TASK TITLE	INSTALLATION OF BATTERY, ELECTRIC CABINET, AND ELECTRIC METER, ETC.	TASK NO.	5032
PERFORMANCE CRITERIA	The person performing this task must be able to install batteries, electrical cabinets and electric meters in accordance with technical requirements, construction requirements, and construction schemes.		
RANGE STATEMENT	The task may be executed under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Electric welding machine; 2. Protractor; 3. Level ruler; 4. High pressure gloves; 5. Insulating shoes; 6. Safety helmet; 7. Crimping plier; 8. Wire stripper; 9. Impact drill; 10. Multimeter; 11. Clamp ammeter; 12. Electrical insulation test meter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Interpret installation construction drawings of household grid-connection PV generation system; 2. Perform material accounting; 3. Conduct on-site investigation; 4. Install batteries, distribution cabinets, and grid-connection cabinets; 5. Install electric energy meters in accordance with the requirements of different grid-connection methods.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Install the battery of the off-grid PV generation system; 1.2 Install the PV generation system distribution cabinet; 1.3 Install the PV generation system grid-connection cabinet. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Components of PV generation system; 2.2 Working principles of PV generation system;	

	2.3 Wiring principles of batteries, cabinets, and electric meters. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Reading theory of installation construction drawings of power generation system. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The batteries, cabinets, and electric meters are installed in accordance with technical requirements and construction requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. General knowledge of machinery; 2. General knowledge of construction; 3. Safety protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	CONSTRUCTION AND INSTALLATION OF HOUSEHOLD PV SYSTEMS	DUTY NO.	503
TASK TITLE	INSTALLATION OF PV CONTROLLERS	TASK NO.	5033
PERFORMANCE CRITERIA	The person performing this task must be able to install PV controllers in accordance with technical requirements, construction requirements, and construction schemes.		
RANGE STATEMENT	The task may be executed under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Electric welding machine; 2. Protractor; 3. Level ruler; 4. High pressure gloves; 5. Insulating shoes; 6. Safety helmet; 7. Crimping plier; 8. Wire stripper; 9. Impact drill; 10. Multimeter; 11. Clamp ammeter; 12. Electrical insulation test meter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Interpret installation construction drawings of household grid-connection PV generation system; 2. Perform material accounting; 3. Conduct on-site investigation; 4. Prepare and select tools; 5. Use an impact drill to drill holes in the wall; 6. Use an electric drill to drill holes on the metal support; 7. Install the PV controller; 8. Install the wind-solar complementary controller; 9. Install the complementary commercial power street light controller.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Read installation construction drawings; 1.2 Perform material accounting; 1.3 Conduct on-site investigation; 1.4 Install the controller. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Components of PV generation system; 2.2 Working principles of PV controller. 3.0 Theories	

	The person performing this task must be able to explain the following contents: 3.1 Reading theory of installation construction drawings of power generation system; 3.2 Application scope of installation tools. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Installation is completed in accordance with technical requirements and construction requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. General knowledge of machinery; 2. General knowledge of construction; 3. Safety protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	CONSTRUCTION AND INSTALLATION OF HOUSEHOLD PV SYSTEMS	DUTY NO.	503
TASK TITLE	INSTALLATION OF PV INVERTERS	TASK NO.	5034
PERFORMANCE CRITERIA	The person performing this task must be able to install PV inverters in accordance with technical requirements, construction requirements, and construction schemes.		
RANGE STATEMENT	The task may be executed under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Electric welding machine; 2. Protractor; 3. Level ruler; 4. High pressure gloves; 5. Insulating shoes; 6. Safety helmet; 7. Crimping plier; 8. Wire stripper; 9. Impact drill; 10. Multimeter; 11. Clamp ammeter; 12. Electrical insulation test meter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Interpret installation construction drawings of household grid-connection PV generation system; 2. Interpret installation construction drawings of complementary PV street lights; 3. Perform material accounting; 4. Conduct on-site investigation; 5. Prepare and select tools; 6. Use an impact drill to drill holes in the wall. 7. Use an electric drill to drill holes on the metal support; 8. Install PV inverters.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Read installation construction drawings; 1.2 Perform material accounting; 1.3 Conduct on-site investigation; 1.4 Install PV inverters. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Components of PV generation system; 2.2 Working principles of PV generation system. 3.0 Theories	

	The person performing this task must be able to explain the following contents: 3.1 Reading theory of installation construction drawings of power generation system; 3.2 Model and application scope of installation tools; 3.3 Functions and type selection knowledge of each PV inverter. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Installation is completed in accordance with technical requirements and construction requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. General knowledge of machinery; 2. General knowledge of construction; 3. Safety protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	HOUSEHOLD PV INSPECTION AND HANDOVER	DUTY NO.	504
TASK TITLE	CHECKING THE STABILITY OF THE FOUNDATION AND SUPPORT OF THE PV GENERATION SYSTEM	TASK NO.	5041
PERFORMANCE CRITERIA	The person performing this task must be able to check the stability of the foundation and support of the PV generation system in accordance with the PV technical requirements and test specifications.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior renewable energy engineering technicians (solar) or a Renewable Energy Engineering Engineer (Solar). The tools and equipment to be used include: 1. Checklist information; 2. Wrench and other support installation tools; 3. Level ruler and plummet; 4. Tape; 5. Flashlight; 6. Personal protective equipment, such as safety helmet, insulating shoes, gloves.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Select the required tools and equipment such as wrenches, level rulers, plummets; 2. Check and determine whether the appearance of concrete foundations, supports, bolts, etc. is in good condition; 3. Check and determine whether the installation dimensions, levelness, verticality, etc. of the foundation and support comply with technical requirements; 4. Check and determine whether the bolts are tightened; 5. Check and determine whether the foundation and support are stable as a whole.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Prevent electric shock; 1.2 Check the tightness of bolts; 1.3 Judge the stability of the foundation and support. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Foundation of PV generation system; 2.2 Technical requirements for stability determination of supports. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Appearance inspection theory for concrete foundations, supports, bolts, etc.; 3.2 Theory for judging the tightening degree of bolts.	

	4.0 Essential Skills 4.1 Communication skills; 4.2 Checklist filling skills; 4.3 Teamwork skills. 5.0 Mathematical Skills 5.1 Calculation of size addition and subtraction; 5.2 Unit conversion of dimensions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The test is carried out and a checklist is issued in accordance with the PV technical requirements and test specifications.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. General knowledge of machinery; 2. General knowledge of construction; 3. Safety protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	HOUSEHOLD PV INSPECTION AND HANDOVER	DUTY NO.	504
TASK TITLE	CHECKING THE ELECTRICAL CONNECTION ACCURACY AND SAFETY OF THE PV GENERATION SYSTEM	TASK NO.	5042
PERFORMANCE CRITERIA	The person performing this task must be able to check whether the electrical connections of the PV generation system are accurate and safe in accordance with the PV technical requirements and test specifications.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Handover list information; 2. Tools such as multimeter; 3. Flashlight; 4. Personal protective equipment, such as safety helmet, insulating shoes, gloves.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Correctly use a multimeter to detect voltage, current, circuit continuity, etc.; 2. Read electrical wiring diagrams; 3. Check and determine whether the electrical wiring is secure or safe; 4. Check and determine whether the electrical wiring is accurate or correct.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Prevent electric shock; 1.2 Use tools such as wrenches to determine whether the electrical wiring is secure and safe; 1.3 Use a multimeter to determine whether the electrical wiring is accurate and correct. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Electrical wiring principles PV generation system; 2.2 Electrical wiring specifications. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Basic principles of electrician internal wire installation;	

	3.2 Criteria for determining the accuracy and safety of electrical connections of the PV generation system. 4.0 Essential Skills 4.1 Communication skills; 4.2 Checklist filling skills; 4.3 Teamwork skills. 5.0 Mathematical Skills 5.1 Unit conversion; 5.2 Rate multiplication.
DESCRIPTION OF THE END PRODUCT / SERVICE	The test is carried out and a checklist is issued in accordance with the PV technical requirements and test specifications.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. General knowledge of machinery; 2. General knowledge of construction; 3. Safety protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	HOUSEHOLD PV INSPECTION AND HANDOVER	DUTY NO.	504
TASK TITLE	COMPLETATION OF THE TIME, COMMUNICATION AND SWITCH STATUS SETTINGS OF PV GENERATION GRID-CONNECTION INVERTERS	TASK NO.	5043
PERFORMANCE CRITERIA	The person performing this task must be able to complete the time, communication and switch status settings of PV generation grid-connection inverters in accordance with the PV technical requirements and manufacturer specifications.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Inverter manual data; 2. Personal protective equipment, such as safety helmet, insulating shoes, gloves.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Read the inverter manual; 2. Check the inverter parameters; 3. Set the inverter parameters.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Prevent electric shock; 1.2 Install and connect the inverter, check whether the circuit meets the requirements, whether the components are loose, whether the insulation is in good condition, and whether the input voltage is normal. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Technical requirements for setting time, communication and switch status of grid-connection inverters. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Key functions of grid-connection inverters;	

	3.2 Technical standards for communication setting of grid-connection inverters. 4.0 Essential Skills 4.1 Communication skills; 4.2 Teamwork skills. 5.0 Mathematical Skills 5.1 Unit conversion.
DESCRIPTION OF THE END PRODUCT / SERVICE	The setting of time, communication and switch status of PV generation grid-connection inverters is completed in accordance with the PV technical requirements and manufacturer specifications.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Safety measures to prevent electric shock; 2. General knowledge of electricians; 3. Manufacturer user manual.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	HOUSEHOLD PV INSPECTION AND HANDOVER	DUTY NO.	504
TASK TITLE	SETTING THE CHARGING AND DISCHARGING PARAMETERS OF THE PV GENERATION CONTROLLER	TASK NO.	5044
PERFORMANCE CRITERIA	The person performing this task must be able to set the charging and discharging parameters of the PV generation controller in accordance with the PV technical requirements and manufacturer specifications.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Controller manual; 2. Personal protective equipment, such as safety helmet, insulating shoes, gloves.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe safety requirements during the setting process to avoid electric shock; 2. Read the controller manual; 3. Check the charging and discharging parameters of the controller; 4. Set the charging and discharging parameters of the controller.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Prevent electric shock; 1.2 Operate the controller, check whether the circuit meets the requirements, whether the components are loose, whether the insulation is in good condition. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Technical standards for setting charging and discharging parameters of PV power generation controllers. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Key functions of the controller; 3.2 Technical standards for setting charging and discharging parameters. 4.0 Essential Skills	

	4.1 Communication skills; 4.2 Teamwork skills. 5.0 Mathematical Skills 5.1 Unit conversion.
DESCRIPTION OF THE END PRODUCT / SERVICE	The charging and discharging parameters of the PV generation controller are set in accordance with the PV technical requirements and manufacturer specifications.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Safety measures to prevent electric shock; 2. General knowledge of electricians; 3. Manufacturer user manual.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	HOUSEHOLD PV INSPECTION AND HANDOVER	DUTY NO.	504
TASK TITLE	EXPLAINING TO USERS THE DAILY USE AND MAINTENANCE METHODS OF HOUSEHOLD GRID- CONNECTION PV GENERATION SYSTEMS	TASK NO.	5045
PERFORMANCE CRITERIA	The person performing this task must be able to explain to users the daily use and maintenance methods of household grid-connection PV generation systems in accordance with the PV technical requirements and actual on-site engineering.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Operation and Maintenance Instructions		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Explain to users the daily use and maintenance methods of household grid-connection PV generation systems; 2. Explain to users the daily use and precautions of household grid-connection PV generation systems.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Operate the grid-connection PV generation system; 1.2 Maintain the grid-connection PV generation system; 1.3 Explain to users the use and maintenance methods and precautions of PV generation systems. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Power generation and grid-connection principles of grid-connection PV generation systems. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Composition of grid-connection PV generation systems; 3.2 Operation of grid-connection PV generation systems; 3.3 Common faults in grid-connection PV generation systems.	

	4.0. Essential Skills 4.1 Correct and fluent interpretation; 4.2 Patient and meticulous attitude; 4.3 Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The daily use and maintenance methods of household grid-connection PV generation systems are explained to users in accordance with the PV technical requirements and actual on-site engineering.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Safety measures to prevent electric shock; 2. General knowledge of electricians; 3. Use and maintenance instructions for relevant manufacturers.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	HOUSEHOLD PV INSPECTION AND HANDOVER	DUTY NO.	504
TASK TITLE	EXPLAINING TO USERS THE DAILY USE AND MAINTENANCE METHODS OF OFF-GRID PV GENERATION SYSTEMS	TASK NO.	5046
PERFORMANCE CRITERIA	The person performing this task must be able to explain to users the daily use and maintenance methods of household off-grid PV generation systems in accordance with the PV technical requirements and actual on-site engineering.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Operation and Maintenance Instructions.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Clean the solar panel, test the photoelectric conversion efficiency and maintain it; 2. Maintain steel supports; 3. Maintain the solar inverter; 4. Check the equipment wiring and grounding; 5. Conduct solar panel cleaning and maintenance procedures; 6. Check the color of the solar cell of the PV panel, the connection of the circuit, template, molded glass, and frame looseness and damage, clean them regularly for half a month, and record the relevant information in the maintenance/repair log; 7. Clean the surface of the PV panel and increase the cleaning frequency appropriately based on the actual situation on site.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Operate the off-grid PV generation system; 1.2 Maintain the off-grid PV generation system. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Power generation and grid-connection principles of off-grid PV generation systems. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1. Composition of off-grid PV generation systems. 3.2. Operation of off-grid PV generation systems; 3.3. Faults of off-grid PV generation systems; 3.4. Maintenance technology for off-grid PV generation systems. 4.0 Essential Skills 4.1. Correct and fluent interpretation;	

	4.2. Patient and meticulous attitude; 4.3. Teamwork skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The daily use and maintenance methods of household off-grid PV generation systems are explained to users in accordance with the PV technical requirements and actual on-site engineering.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Safety measures to prevent electric shock; 2. General knowledge of electricians; 3. Use and maintenance instructions for relevant manufacturers.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	OPERATION AND MAINTENANCE OF HOUSEHOLD PV SYSTEMS	DUTY NO.	505
TASK TITLE	ANALYSIS AND DETERMINATION OF THE CAUSE OF THE FAULT BASED ON THE FAULT PHENOMENON OF INDEPENDENT SOLAR STREET LIGHTS	TASK NO.	5051
PERFORMANCE CRITERIA	The person performing this task must be able to determine the fault phenomenon of independent solar street lights, analyze and determine the cause of the fault based on the phenomenon, and repair the fault.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Equipment list; 2. Tools such as multimeter; 3. Flashlight; 4. Personal protective equipment, such as safety helmet, insulating shoes, gloves.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Select tools and equipment such as multimeter; 2. Check the appearance for damage; 3. Check if the battery has run out of charge; 4. Check whether the controller has broken wires or short circuits; 5. Find the cause of the fault and repair it; 6. Clean the tools, equipment and workplace; 7. Store tools and equipment.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1. Check the battery; 1.2. Check the controller; 1.3. Find the cause of the fault and repair it. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Electrical schematic diagrams of solar street lights; 2.2 Protection design principles of the solar street light. 3.0 Theories The person performing this task must be able to explain the following contents: 3.1 Common fault detection and diagnosis techniques for batteries and controllers. 4.0 Essential Skills	

	4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to detect and determine the cause of the fault of solar street lights, and issue a fault detection, diagnosis, and repair report.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Safety measures to prevent electric shock; 2. General knowledge of electricians; 3. Use and maintenance instructions for relevant manufacturers.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	OPERATION AND MAINTENANCE OF HOUSEHOLD PV SYSTEMS	DUTY NO.	505
TASK TITLE	ANALYSIS AND DETERMINATION OF THE CAUSE OF THE FAULT BASED ON THE FAULT PHENOMENON OF THE LOW- POWER PV PUMP	TASK NO.	5052
PERFORMANCE CRITERIA	The person performing this task must be able to determine the fault phenomenon of low-power PV pumps, analyze and determine the cause of the fault based on the phenomenon, and repair the fault.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Equipment list; 2. Tools such as multimeter; 3. Flashlight; 4. Personal protective equipment, such as safety helmet, insulating shoes, gloves.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Choose suitable tools and equipment for the task; 2. Check the appearance for damage; 3. Check if the battery has run out of charge; 4. Check whether the controller has broken wires or short circuits; 5. Check whether the motor has broken wires or short circuits; 6. Find the cause of the fault and repair the appearance inspection; 7. Clean the tools, equipment and workplace; 8. Store tools and equipment.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Check the appearance; 1.2 Check the battery; 1.3 Check the controller; 1.4 Check the motor; 1.5 Find the cause of the fault and repair it. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Technical requirements for motor structure and wiring; 2.2 Technical requirements for batteries and controllers. 3.0 Theories The person performing this task must be able to explain the following contents:	

	3.1 Working principle of motor; 3.2 Common fault detection and diagnosis techniques for batteries and controllers. 4.0. Essential Skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to determine the cause of the fault of low-power PV pumps, and issue a fault detection, diagnosis, and repair report.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Safety measures to prevent electric shock; 2. General knowledge of electricians; 3. Use and maintenance instructions for relevant manufacturers.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	OPERATION AND MAINTENANCE OF HOUSEHOLD PV SYSTEMS	DUTY NO.	505
TASK TITLE	ANALYSIS AND DETERMINATION OF THE CAUSE OF THE FAULT BASED ON THE FAULT PHENOMENON OF THE SOLAR PV LIGHTING DEVICE	TASK NO.	5053
PERFORMANCE CRITERIA	The person performing this task must be able to determine the fault phenomenon of the solar PV lighting device, analyze and determine the cause of the fault based on the phenomenon, and repair the fault.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Equipment list; 2. Tools such as multimeter; 3. Flashlight; 4. Personal protective equipment, such as safety helmet, insulating shoes, gloves.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Select tools and equipment such as multimeter for the task; 2. Check the appearance of the solar panel for damage; 3. Check if the battery has run out of charge; 4. Check whether the controller has broken wires or short circuits; 5. Find the cause of the fault and repair solar energy; 6. Clean the tools, equipment and workplace; 7. Store tools and equipment.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Check the appearance of the battery panel; 1.2 Check the battery; 1.3 Check the controller; 1.4 Check the wiring of the lighting device; 1.5 Find the cause of the fault and repair it. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Solar power principle; 2.2 Technical requirements for batteries and controllers. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Structure and technical requirements of solar panels;	

	3.2 Common fault detection and diagnosis techniques for batteries and controllers. 4.0 Essential Skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to determine the cause of the fault of the solar PV lighting device, and issue a fault detection, diagnosis, and repair report.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Safety measures to prevent electric shock; 2. General knowledge of electricians; 3. Use and maintenance instructions for relevant manufacturers.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)	OCCUPATION CODE	
DUTY TITLE	OPERATION AND MAINTENANCE OF HOUSEHOLD PV SYSTEMS	DUTY NO.	505
TASK TITLE	ANALYSIS AND DETERMINATION OF THE CAUSE OF THE FAULT BASED ON THE FAULT PHENOMENON OF THE DC PV POWER SUPPLY WITH A BATTERY	TASK NO.	5054
PERFORMANCE CRITERIA	The person performing this task must be able to determine the fault phenomenon of the DC PV power supply with a battery, analyze and determine the cause of the fault based on the phenomenon, and repair the fault.		
RANGE STATEMENT	The task can be performed on household PV engineering site under the supervision of senior technicians or renewable energy engineering technicians (solar). The tools and equipment to be used include: 1. Equipment list; 2. Tools such as multimeter; 3. Flashlight; 4. Personal protective equipment, such as safety helmet, insulating shoes, gloves.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Select tools and equipment such as multimeterfor the task; 2. Check the appearance of the battery; 3. Check the battery circuit; 4. Check the battery capacity; 5. Check whether there is a short circuit in the battery; 6. Find the cause of the fault and repair it; 7. Clean the tools, equipment and workplace; 8. Store tools and equipment.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Check whether the appearance of the battery is damaged; 1.2 Check whether the battery circuit is disconnected; 1.3 Check whether the battery capacity is insufficient; 1.4 Check whether there is a short circuit in the battery; 1.5 Find the cause of the fault and repair it. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Technical requirements for wiring of DC PV power supply. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Functions of batteries;	

	3.2 Common fault detection and diagnosis techniques for batteries. 4.0 Essential Skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to determine the fault phenomenon of the DC PV power supply with a battery, analyze and determine the cause of the fault based on the phenomenon, and repair the fault.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Safety measures to prevent electric shock; 2. General knowledge of electricians; 3. Use and maintenance instructions for relevant manufacturers.

**TABLE 1: DACUM CHARTS FOR RENEWABLE ENERGY ENGINEERING
TECHNICIAN (SOLAR) - NTA 5**

DUTIES	TASKS	ENABLERS
1.0 Reading of household PV construction drawings	1.1 Reading of the construction drawings of photovoltaic power generation subsystem. 1.2 Reading of construction drawings of power storage subsystem.	Generic skills and knowledge • Principles of household grid-connection PV generation system • Principles of AC/DC hybrid off-grid PV generation system • Principles of independent wind-solar street lights, complementary commercial power street lights and off-grid wind-solar power generation system • Principles of energy storage subsystem • Construction methods for installing the energy storage subsystem Tools and equipment • Principle wiring drawings Materials • Drawings Worker behaviors • Teamwork, integrity, time management and commitment
2.0 Determination of the household PV construction scheme	2.1 Determination of the installation location, support foundation method, and cable laying plan of household grid-connection PV generation system.	Generic skills and knowledge • Principles of installation angle of PV supports • Principles of controllers and inverters Tools and equipment • PV support • PV module • PV controller • Inverter • Battery • Electric cabinet, electric meter, communication line, cable, etc. Materials • Wire and cable Worker behaviors • Teamwork, integrity, time management and commitment

DUTIES	TASKS	ENABLERS
3.0 Installation of household PV system	3.1 Completion of the foundation construction of PV supports in accordance with construction drawings. 3.2 Installation of double-sided PV modules. 3.3 Installation of PV controllers. 3.4 Installation of PV inverters. 3.5 Installation of batteries, electric cabinets, and electric meters, etc.	Generic skills and knowledge • Knowledge of reading of installation and construction drawings, system composition, working principles, functions and selection of various components of power generation systems • Knowledge of reading of installation and construction drawings, system composition, working principles, functions and selection of batteries, electrical cabinets and electric meters • Knowledge of reading of installation and construction drawings, system composition, working principles, functions and selection of PV controllers Tools and equipment • Electric welding machine • Protractor • Level ruler • High pressure gloves • Insulating shoes • Safety helmet • Crimping plier • Wire stripper • Impact drill • Multimeter • Clamp ammeter • Electrical insulation test meter Materials • Construction materials and wires that comply with the requirements Worker behaviors • Teamwork, integrity, time management and commitment
4.0 Inspection and handover of household PV system	4.1 Checking the stability of the foundation and support of the PV generation system. 4.2 Checking the electrical connection accuracy and safety of the PV generation system.	Generic skills and knowledge • Criteria for determining the stability of the foundation and support of PV generation systems • Criteria for determining the accuracy and safety of electrical connections of the PV generation system

DUTIES	TASKS	ENABLERS
	4.3 Completion of the time, communication and switch status settings of PV generation grid-connection inverters. 4.4 Setting the charging and discharging parameters of the PV generation controller. 4.5 Explaining to users the daily use and maintenance methods of household grid-connection PV generation systems. 4.6 Explaining to users the daily use and maintenance methods of off-grid PV generation systems.	- Criteria for setting time, communication and switch status of grid-connection inverters - Criteria for setting the charging and discharging parameters of PV generation controllers - Power generation and grid-connection principles of grid-connection PV generation systems Tools and equipment - Multimeter, safety helmet, insulating shoes, gloves, etc. Materials - Wire and cable Worker behaviors - Teamwork, integrity, time management and commitment
5.0 Operation and maintenance of household PV system	5.1 Analysis and determination of the cause of the fault based on the fault phenomenon of independent solar street lights. 5.2 Analysis and determination of the cause of the fault based on the fault phenomenon of the low-power PV pump. 5.3 Analysis and determination of the cause of the fault based on the fault phenomenon of the solar PV lighting device. 5.4 Analysis and determination of the cause of the fault based on the fault phenomenon of the DC PV power supply with a battery.	Generic skills and knowledge - Power generation principles of solar street lights - Common faults of batteries and controllers - Working principles of motors Tools and equipment - Multimeter, safety helmet, insulating shoes, gloves, etc. Materials - Wire and cable Worker behaviors - Teamwork, integrity, time management and commitment