NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

MAY 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: RENEWABLE ENERGY ENGINEERING TECHNICIAN (SOLAR)

LEVEL: NTA 4

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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 Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.
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.
Occupational/Job analysis:	A process used to identify the tasks that are important to employees in any given occupation.
Performance Criteria:	Indicate expected end results or outcomes 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 for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, and 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.

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 Technician (Solar) 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. NACTE 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 a stakeholder forum were used to validate the Occupational Standards. Engineers, supervisory technicians on the job, and experienced Renewable Energy Engineering Technicians were key

informants in the survey to discover occupational trends. This information was used to gain insight from the workplaces regarding trends and changes in the profession, 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)

The 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.

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

The Occupational Standards will be valid for 3-5 years due to the fast-changing nature of technology. The review will proceed in the same manner as the previous one, with new occupational standards being developed based on current labour market information.

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS OF RENEWABLE ENERGY ENGINEERING TECHNICIANS - NTA 4

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EQUIPMENT SELECTION AND MATERIAL ACCOUNTING FOR THE SMALL PV SYSTEM	**DUTY NO.**	401
TASK TITLE	EQUIPMENT SELECTION AND MATERIAL ACCOUNTING FOR SOLAR STREET LIGHTS	**TASK NO.**	4011
PERFORMANCE CRITERIA	The person performing this task must be able to perform the equipment model selection of solar street lights and the calculation of the required material amount according to the design scheme and construction drawings.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Steel tape, steel ruler； 2. Distance measuring instrument； 3. Level ruler; 4. Level gauge.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the type of PV modules; 2. Select the power and model of lights; 3. Select the type of solar light poles and bases; 4. Select the type and capacity of batteries; 5. Select the type of charging and discharging controllers; 6. Determine the basic size; 7. Perform material accounting for foundation and base construction; 8. Perform amount accounting for light bulbs, light beads or lighting sets; 9. Perform material accounting for installation of light poles and bases; 10. Perform material accounting for such auxiliary materials as cables, cable lugs, wiring terminals, screws and spacers.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read the installation drawings of solar street lights; 1.2 Select the parameters of PV modules; 1.3 Calculate the capacity of PV modules; 1.4 Select the type and capacity of the batteries; 1.5 Determine the foundation form and size; 1.6 Calculate the power of lighting sets; 1.7 Estimate the amount of auxiliary materials. **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 Basic principle of PV power generation; 2.3 Working principle of the charging and discharging controller;

	2.4 Working principle of batteries. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Content of construction drawings for solar street lights; 3.2 Method and basis of selecting types of solar street lights; 3.3 Method and basis of material accounting for solar street lights. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The table of equipment types selected and material accounting for solar street lights is prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EQUIPMENT SELECTION AND MATERIAL ACCOUNTING FOR THE SMALL PV SYSTEM	**DUTY NO.**	401
TASK TITLE	EQUIPMENT SELECTION AND MATERIAL ACCOUNTING FOR PV PUMPS	**TASK NO.**	4012
PERFORMANCE CRITERIA	The person performing this task must be able to perform the equipment model selection of PV pumps and the calculation of the required material amount according to the design scheme and construction drawings.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Steel tape, steel ruler 2. Distance measuring instrument 3. Level ruler; 4. Level gauge.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the type of PV modules; 2. Select the power and model of pumps; 3. Select the model of frequency converters; 4. Select the type and capacity of batteries; 5. Select the type of charging and discharging controllers; 6. Determine the sizes of foundation and structure; 7. Perform material accounting for foundation construction; 8. Perform material accounting for PV modules; 9. Perform material accounting for pipes; 10. Select the size and specification of batteries; 11. Select the model and specification of distribution boxes; 12. Perform material accounting for such auxiliary materials as cables, cable lugs, wiring terminals, screws and spacers.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read the installation drawings of PV pumps; 1.2 Calculate the pump flow, lift and pipe diameter; 1.3 Select the parameters and capacity of PV modules; 1.4 Select the pump model; 1.5 Select the model of frequency converters; 1.6 Select the type and capacity of the batteries; 1.7 Select the type of charging and discharging controllers; 1.8 Calculate the sizes of foundation and structure; 1.9 Calculate the battery capacity; 1.10 Estimate the amount of auxiliary materials. **2.0 Principle** The person performing this task must be

	able to explain the following principles: 2.1 Electrical schematic diagrams of PV pumps; 2.2 Basic principle of PV power generation; 2.3 Working principle of frequency converters; 2.4 Working principle of batteries; 2.5 Calculating principle of the pump flow, lift and pipe diameters. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Content of PV pump construction drawings; 3.2 Method and basis of selecting types of PV pumps; 3.3 Method and basis of material accounting for PV pumps. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The table of equipment types selected and material accounting for PV pumps are prepared.

CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EQUIPMENT SELECTION AND MATERIAL ACCOUNTING FOR THE SMALL PV SYSTEM	**DUTY NO.**	401
TASK TITLE	EQUIPMENT SELECTION AND MATERIAL ACCOUNTING FOR THE SMALL OFF-GRID PV GENERATION SYSTEM	**TASK NO.**	4013
PERFORMANCE CRITERIA	The person performing this task must be able to perform the equipment model selection for the small off-grid PV generation system and the calculation of the required material amount according to the design scheme and construction drawings.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Steel tape, steel ruler 2. Distance measuring instrument 3. Level ruler; 4. Level gauge.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the type of PV modules; 2. Calculate the total load power; 3. Select the battery type; 4. Select the size and capacity of batteries; 5. Select the type of solar controllers; 6. Select the type of off-grid inverters; 7. Calculate the capacity ratio of off-grid inverters; 8. Select the type of monitoring modules; 9. Select the types of AC/DC distribution boxes; 10. Calculate the capacity and select the type of battery cabinets; 11. Calculate the capacity of PV modules; 12. Calculate the total capacity of batteries; 13. Perform material accounting for	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read the installation drawings of the system; 1.2 Select the parameters of PV modules; 1.3 Calculate the total load power; 1.4 Select the type and capacity of the batteries; 1.5 Select the specification and model of solar controllers; 1.6 Select the specification and model of inverters; 1.7 Select the model and specification of AC/DC distribution boxes; 1.8 Calculate the capacity of PV modules; 1.9 Calculate the battery capacity; 1.10 Estimate the amount of auxiliary materials. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Electrical schematic diagrams of the small off-grid PV generation system; 2.2 Basic principle of PV power generation;

such auxiliary materials as cables, cable lugs, wiring terminals, screws and spacers.	2.3 Working principles of the solar controller and MPPT 2.4 Working principle of the off-grid inverter; 2.5 Calculating principle of load capacity. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Content of the construction drawings for the small off-grid PV generation system; 3.2 Method and basis of selecting the equipment type for the small off-grid PV generation system; 3.3 Method and basis of material accounting for the small off-grid PV generation system. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The table of equipment type selected and material accounting for the small off-grid PV generation system are prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EQUIPMENT SELECTION AND MATERIAL ACCOUNTING FOR THE SMALL PV SYSTEM	**DUTY NO.**	401
TASK TITLE	EQUIPMENT SELECTION AND MATERIAL ACCOUNTING FOR THE SMALL GRID-CONNECTION PV GENERATION SYSTEM	**TASK NO.**	4014
PERFORMANCE CRITERIA	The person performing this task must be able to perform the equipment model selection for the small grid-connection PV generation system and the calculation of the required material amount according to the design scheme and construction drawings.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Steel tape, steel ruler 2. Distance measuring instrument 3. Level ruler; 4. Level gauge.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the spacing of PV arrays; 2. Determine the orientation and dip angle of PV arrays; 3. Calculate the total load power; 4. Select the method of building the foundation; 5. Select the type of PV modules; 6. Determine the type and size of the PV supports; 7. Select the type of grid-connection inverters; 8. Calculate the capacity ratio of grid-connection inverters; 9. Select the type of monitoring modules; 10. Select the type of DC distribution boxes; 11. Select the types of AC combiner boxes and circuit breakers; 12. Calculate materials for foundation construction;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read the installation drawings of the system; 1.2 Calculate the sizes of foundation and structure; 1.3 Select the model and specification of PV modules; 1.4 Calculate the capacity of PV modules; 1.5 Select the specification and model of PV supports; 1.6 Calculate the amount of PV supports; 1.7 Select the specification and model of grid-connection inverters; 1.8 Determine the capacity ratio of grid-connection inverters; 1.9 Select the specification and model of DC distribution boxes; 1.10 Select the specification and model of AC combiner boxes; 1.11 Estimate the amount of auxiliary materials. **2.0 Principle** The person performing this task must be able to explain the following principles:

13. Calculate the total installed capacity of PV modules; 14. Calculate materials needed for PV supports; 15. Calculate the types and materials of AC/DC cables; 16. Perform material accounting for such auxiliary materials as wiring ducts, cable lugs, wiring terminals, screws and spacers.	2.1 Electrical schematic diagrams of the small grid-connection PV generation system; 2. Basic principle of PV power generation; 2.3 Working principle of the grid-connection inverter; 2.4 Meaning of solar energy irradiance and radiation quantity; 2.5 Principle of calculating the theoretical generating capacity. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Content of the construction drawings for the small grid-connection PV generation system; 3.2 Method and basis of slecting the equipment type for the small grid-connection PV generation system; 3.3 Method and basis of material accounting for the small grid-connection PV generation system. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The table of equipment type selected and material accounting for the small grid-connection PV generation system are prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EQUIPMENT INSTALLATION AND ELECTRICAL CONNECTIONS FOR THE SMALL PV SYSTEM	**DUTY NO.**	402
TASK TITLE	CONSTRUCTION OF FOUNDATION AND SUPPORT COMPONENTS	**TASK NO.**	4021
PERFORMANCE CRITERIA	The person performing this task must be able to perform the construction of foundation and support components of the small PV system.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Mining tools such as pile driver, shovel and pickax; 2. Steel tape, distance measuring instrument, level gauge; 3. Universal tool kits for electricians; 4. Wrench & socket kits, inner hexagon wrench kits, monkey wrenches; 5. MC4 tool kits; 6. Wire strippers, press pliers, diagonal pliers, needle-nose pliers; 7. Safety helmets, insulating gloves, insulating boots, temporary blocks, seat belts, insulation ladders, climbers.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the installation drawings of the system; 2. Prepare and standardly place various section steels, pipes, cables, wires, compensating traverses, machined parts, fasteners, screws, spacers and other auxiliary materials listed in the material list in accordance with the drawings; 3. Select the types of various tools and place them standardly; 4. Determine the size and position of the foundation; 5. Select the building method for the ground foundation; 6. Select the building method for the roof foundation; 7. Pour the concrete foundation;	**Detailed knowledge about:** 1.0 **Methods** The person performing this task must be able to explain how to: 1.1 Use tools correctly; 1.2 Use measuring instruments correctly; 1.3 Determine the position and size of the foundation; 1.4 Pour the concrete foundation; 1.5 Make the pile foundation; 1.6 Connect the support and the foundation; 1.7 Connect the guide rails and the support; 1.8 Regulate the support orientation and dip angle. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principle of reading the construction and installation drawings for the small PV system; 2.2 Structure principle of the support components;

8. Drive the impact pile foundation into the ground with the pile driver; 9. Drive the screw pile foundation into the ground with the equipment; 10. Connect the solar energy light pole and the foundation; 11. Connect the support and the foundation; 12. Connect the support and the concrete balance-weight foundation; 13. Connect the support and the roof fittings; 14. Connect the support components; 15. Install the guide rails of components and connect them to the support; 16. Regulate the support orientation and the dip angle.	2.3 Principle of support orientation and dip angle affecting the power generation efficiency; 2.4 Safety codes for site construction. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Content of the construction and installation drawings for the small PV system; 3.2 Theory of calculating the foundation size; 3.3 Advantages and disadvantages of different types of foundation. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The building of the foundation and support components for the small PV system will be completed.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EQUIPMENT INSTALLATION AND ELECTRICAL CONNECTIONS FOR THE SMALL PV SYSTEM	**DUTY NO.**	402
TASK TITLE	INSTALLATION OF PV MODULE	**TASK NO.**	4022
PERFORMANCE CRITERIA	The person performing this task must be able to install the PV modules for the small PV system.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Steel tapes, distance measuring instruments, level gauges; 2. Clamp ammeter, digital multimeter, insulation resistance meter; 3. Universal tool kits for electricians; 4. Wrench & socket kits, inner hexagon wrench kits, monkey wrenches; 5. MC4 tool kits; 6. Wire strippers, press pliers, diagonal pliers, needle-nose pliers; 7. Safety helmets, insulating gloves, insulating boots, temporary blocks, seat belts, insulation ladders, climbers.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the installation drawings of the system; 2. Prepare and standardly place the auxiliary materials in accordance with the drawings; 3. Select the types of various tools and place them standardly; 4. Prepare safety tools; 5. Prepare measuring instruments; 6. Perform unpacking inspection for the PV modules; 7. Handle the PV modules properly; 8. Fix the PV modules on the support guide rails; 9. Perform fine adjustment for the orientation and dip angle of PV modules; 10. Clean the surface of PV	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use tools correctly; 1.2 Use measuring instruments correctly; 1.3 Perform unpacking inspection for PV modules; 1.4 Handle PV modules in accordance with the specifications; 1.5 Fix the PV modules on the support guide rails; 1..6 Perform fine adjustment for the orientation and dip angle of modules; 1.7 Test the open-circuit voltage of PV modules; 1.8 Test the short-circuit current of PV modules; 1.9 Test the insulation resistance of PV modules. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principle of reading the construction and installation drawings for the small PV system; 2.2 Basic principle of PV power generation;

modules; 11. Test the open-circuit voltage of PV modules; 12. Test the short-circuit current of PV modules; 13. Test the insulation resistance of PV modules.	2.3 Inspection and use requirements for safety tools; 2.4 Safety codes for site construction. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Content of the construction and installation drawings for the small PV system; 3.2 Qualified standards of PV modules; 3.3 Theory of data processing; 3.4 Principle of the component orientation and dip angle affecting the power generation efficiency. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The installation of solar components for the small PV system will be completed in accordance with the specifications.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EQUIPMENT INSTALLATION AND ELECTRICAL CONNECTIONS FOR THE SMALL PV SYSTEM	**DUTY NO.**	402
TASK TITLE	DEVICE INSTALLATION AND ELECTRICAL CONNECTION	**TASK NO.**	4023
PERFORMANCE CRITERIA	The person performing this task must be able to complete the equipment installation and electrical connection for the small PV system.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Steel tapes, distance measuring instruments, level gauges; 2. Clamp ammeter, digital multimeter, insulation resistance meter; 3. Universal tool kits for electricians; 4. Wrench & socket kits, inner hexagon wrench kits, monkey wrenches; 5. MC4 tool kits; 6. Wire strippers, press pliers, diagonal pliers, needle-nose pliers; 7. Safety helmets, insulating gloves, insulating boots, temporary blocks, seat belts, insulation ladders, climbers.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the installation drawings of the system; 2. Read the electrical schematic diagrams of the system; 3. Check the equipment to be installed for the system in accordance with the equipment list; 4. Prepare and standardly place the auxiliary materials in accordance with the drawings; 5. Select the types of various tools and place them standardly; 6. Prepare measuring instruments; 7. Install and adjust solar light sets; 8. Install and adjust PV pumps and	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use tools correctly; 1.2 Use measuring instruments correctly; 1.3 Install the equipment of each subsystem; 1.4 Make MC4 photovoltaic connectors; 1.5 Install and fix wire pipes and wiring duct; 1.6 Lay and fix AC/DC cables; 1.7 Measure the insulation resistance of equipment; 1.8 Measure the output voltage of inverters; 1.9 Measure the output voltage, current and frequency at the grid-connection points; 1.10 Install and debug the communication module. **2.0 Principle** The person performing this task must be able to explain the

pipes; 9. Install charging and discharging controllers; 10. Install batteries and battery cabinets; 11. Install frequency converters; 12. Install solar controllers; 13. Install AC/DC combiner boxes; 14. Install circuit breakers, fuses and surge protectors; 15. Install off-grid inverters; 16. Install grid-connection inverters; 17. Make and connect MC4 photovoltaic connectors; 18. Connect PV modules/clusters; 19. Connect the equipotential connecting terminals; 20. Install grounding protection wires for arrays; 21. Pre-embed and fix DC wire pipes/wiring ducts; 22. Connect arrays and DC combiner boxes and lay cables; 23. Pre-embed and fix AC wire pipes/wiring ducts; 24. Connect DC combiner boxes and inverters and lay cables; 25. Connect inverters and DC combiner boxes and lay cables; 26. Bind and fix cables and wiring ducts; 27. Measure the insulation resistances of clusters and arrays; 28. Measure the insulation resistances of combiner boxes and inverters; 29. Measure the open-circuit voltage and short circuit current of modules; 30. Measure the open-circuit voltage and short circuit current of clusters and arrays; 31. Measure the output voltage of inverters; 32. Measure the output voltage and frequency at the grid-connection points;	following principles: 2.1 Principle of reading electrical schematic diagrams of products; 2.2 Basic principle of PV power generation; 2.3 Working principle of the communication module; 2.4 Safety codes for site construction; 2.5 Safety specifications for electrician operation. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Content of electrical schematic diagrams of products; 3.2 Effect of inverter output parameters on grid-connection; 3.3 Basic theories for open-circuit voltage and short-circuit current. **4.0 Essential Skills** 4.1 “6S” occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.

33. Install and debug the communication module; 34. Conduct the test and safety inspection before grid-connection.	
DESCRIPTION OF THE END PRODUCT / SERVICE	The equipment installation and electrical connection for the small PV system will be completed in accordance with the specifications.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SETTING OF THE OPERATION MODE AND PARAMETERS FOR THE SMALL PV SYSTEM	**DUTY NO.**	403
TASK TITLE	SETTING OF THE OPERATION MODE AND PARAMETERS FOR THE SOLAR STREET LIGHTS	**TASK NO.**	4031
PERFORMANCE CRITERIA	The person performing this task must be able to set the operation mode and parameters for solar street lights in accordance with the product technical parameters.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Remote controllers for solar street lights; 2. Smartphone (with pre-installed APP for product monitoring); 3. Laptop (with pre-installed client for product monitoring); 4. Digital multimeter; 5. Clamp ammeter; 6. Universal tool kits for electricians; 7. MC4 tool kits.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select different operation modes for solar street lights according to seasons and weather changes; 2. Set the time-controlled operation mode for solar street lights; 3. Set the light-controlled operation mode for solar street lights; 4. Set the time and light controlling combined operation mode; 5. Set the time-controlled parameters for solar street lights; 6. Set the light-controlled parameters for solar street lights; 7. Set parameters for the time and light controlling combined operation mode; 8. Adjust the brightness and angle of solar street lights; 9. Adjust the orientation and dip angle of PV modules; 10. Set the operation mode and	**Detailed knowledge about:** **3.0 Methods** The person performing this task must be able to explain how to: 1.1 Operate remote controllers for solar street lights; 1.2 Operate the APP for monitoring solar street lights; 1.3 Operate the client for monitoring solar street lights; 1.4 Set the time-controlled operation mode for solar street lights; 1.5 Set the light-controlled operation mode for solar street lights; 1.6 Set the time and light controlling combined operation mode; 1.7 Adjust the brightness and angle of solar street lights; 1.8 Adjust the orientation and dip angle of PV modules. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principle of light controlling; 2.2 Basic principle of time controlling; 2.3 Basic principle of the remote controller or monitoring

parameters for solar street lights with the remote controller; 11. Set the operation mode and parameters for solar street lights through the mobile phone APP (if any); 12. Set the operation mode and parameters for solar street lights through the computer client (if any).	system. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Theory of calculating the power and power consumption; 3.2 Theory of seasons and weather changes affecting the operation mode. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	Operation modes and parameters will be set correctly according to the usage scenarios of solar street lights.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SETTING OF THE OPERATION MODE AND PARAMETERS FOR THE SMALL PV SYSTEM	**DUTY NO.**	403
TASK TITLE	SETTING OF THE OPERATION MODE AND PARAMETERS FOR PV PUMPS	**TASK NO.**	4032
PERFORMANCE CRITERIA	The person performing this task must be able to set the operation mode and parameters for PV pumps in accordance with the product technical parameters.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Digital multimeter; 2. Clamp ammeter; 3. Insulation resistance meter; 4. Smartphone (with pre-installed APP for product monitoring); 5. Laptop (with pre-installed client for product monitoring); 6. Universal tool kits for electricians; 7. MC4 tool kits.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Adjust the lift and flow of PV pumps according to the usage requirements; 2. Switch the automatic operation mode of PV pumps; 3. Switch the manual operation mode of PV pumps; 4. Set the automatic control parameters for frequency converters; 5. Set the manual control parameters for frequency converters; 6. Adjust the orientation and dip angle of PV modules; 7. Switch the local control and remote control of the system; 8. Set the operation mode and parameters for PV pumps through the mobile phone APP (if any); 9. Set the operation mode and parameters for the PV pumps	**Detailed knowledge about:** **3.0 Methods** The person performing this task must be able to explain how to: 1.1 Adjust the lift and flow of PV pumps; 1.2 Switch the automatic and manual operation of PV pumps; 1.3 Set the automatic and manual control parameters for frequency converters; 1.4 Adjust the orientation and dip angle of PV modules; 1.5 Switch the local/remote control of the system. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principle of frequency converters; 2.2 Basic principle of automatic operation for the pump; 2.3 Basic principle of the monitoring system. **3.0 Theories** The person performing this task must be able to explain the following contents:

through the computer client (if any).	3.1 Theory of calculating the power and power consumption; 3.2 Theory of calculating the pipe diameter, flow and lift for pumps; 3.3 Usage scenarios for different operation modes. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	Operation modes and parameters will be set correctly according to the usage scenarios of PV pumps.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SETTING OF THE OPERATION MODE AND PARAMETERS FOR THE SMALL PV SYSTEM	**DUTY NO.**	403
TASK TITLE	SETTING OF THE OPERATION MODE AND PARAMETERS FOR THE SMALL OFF-GRID PV GENERATION SYSTEM	**TASK NO.**	4033
PERFORMANCE CRITERIA	The person performing this task must be able to set the operation mode and parameters for the small off-grid PV generation system in accordance with the product technical parameters.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Smartphone (with pre-installed APP for product monitoring); 2. Laptop (with pre-installed client for product monitoring); 3. Digital multimeter; 4. Clamp ammeter; 5. Insulation resistance meter; 6. Universal tool kits for electricians; 7. MC4 tool kits.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select different system operation modes according to load changes; 2. Switch the automatic operation mode of the system; 3. Switch the manual operation mode of the system; 4. Set the automatic operation parameters for the system; 5. Set the manual operation parameters for the system; 6. Switch the local/remote control of the system; 7. Adjust the charge and discharge depth for the batteries; 8. Adjust the output power of the system; 9. Set the protection limit of the system; 10. Set the monitoring and parameters of the system through	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Switch the operation modes of the system; 1.2 Set the automatic/manual control parameters; 1.3 Switch the local/remote control; 1.4 Adjust the output power of the system; 1.5 Adjust the charge and discharge depth for the batteries; 1.6 Set the protection limit of the system. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principle of the monitoring system; 2.2 Working principles of the solar controller and MPPT; 2.3 Working principle of the off-grid inverter; **3.0 Theories** The person performing this task must be able to explain

the mobile phone APP (if any); 11. Set the monitoring and parameters of the system through the computer client (if any); 12. View the system efficiency and electric quantity statistics.	the following contents: 3.1 Theory of calculating the load power and power consumption; 3.2 Theory of load power changes affecting the operation mode; 3.3 Theory of charge and discharge depth affecting the service life of batteries. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The operation modes and parameters will be set correctly according to the usage scenarios of the small off-grid PV generation system.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SETTING OF THE OPERATION MODE AND PARAMETERS FOR THE SMALL PV SYSTEM	**DUTY NO.**	403
TASK TITLE	SETTING OF THE OPERATION MODE AND PARAMETERS FOR THE SMALL GRID-CONNECTION PV GENERATION SYSTEM	**TASK NO.**	4034
PERFORMANCE CRITERIA	The person performing this task must be able to set the operation mode and parameters for the small grid-connection PV generation system in accordance with the product technical parameters.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Smartphone (with pre-installed APP for product monitoring); 2. Laptop (with pre-installed client for product monitoring); 3. Digital multimeter; 4. Clamp ammeter; 5. Insulation resistance meter; 6. Universal tool kits for electricians; 7. MC4 tool kits.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Conduct inspection before grid-connection of the system; 2. Conduct safe grid-connection of the system in correct steps; 3. Conduct safe grid-disconnection of the system in correct steps; 4. Make the whole or part of the system put into or exit from the power grid in correct steps; 5. Test the parameters for the arrays and clusters before grid-connection; 6. Test the DC side parameters before grid-connection; 7. Set the parameters of inverters before grid-connection; 8. Test parameters at grid-connection points; 9. Switch the local/remote control of	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use tools correctly; 1.2 Use measuring instruments correctly; 1.3 Conduct inspection before grid-connection of the system; 1.4 Make the system put into or exit from the power grid; 1.5 Switch local/remote control mode of the system; 1.6 Test the open-circuit voltage of arrays and clusters; 1.7 Test the short-circuit current of arrays and clusters; 1.8 Set the parameters for grid-connection inverters; 1.9 Test the voltage, current and frequency at grid-connection points. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Way to read the electrical schematic diagrams of the

the system; 10. Set the protection limit of the system; 11. Set the monitoring and parameters of the system through the mobile phone APP (if any); 12. Set the monitoring and parameters of the system through the computer client (if any); 13. View the system efficiency and electric quantity statistics.	system; 2.2 Working principle of MPPT; 2.3 Working principle of the grid-connection inverter; **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Theory of calculating the installed capacity and generating capacity; 3.2 Meaning of irradiance and radiant quantity; 3.3 Theory of calculating the system efficiency. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The operation modes and parameters will be set correctly according to the usage scenarios of the small grid-connection PV generation system.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	HANDING OVER EQUIPMENT	**DUTY NO.**	404
TASK TITLE	EXPLAINING THE OPERATION AND RUNNING OF THE SYSTEM TO THE USERS	**TASK NO.**	4041
PERFORMANCE CRITERIA	The person performing this task must be able to hand over the full set of equipment and spare parts to the users and explain the operation method for the normal running of the system to them.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Remote controllers for solar street lights; 2. Smartphone (with pre-installed APP for product monitoring); 3. Laptop (with pre-installed client for product monitoring); 4. Digital multimeter; 5. Clamp ammeter; 6. Universal tool kits for electricians; 7. MC4 tool kits.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Hand over a full set of equipment with perfect function to the user as per the list; 2. Hand over spare parts to the user as per the list; 3. Explain the remote operation of solar street lights to the user; 4. Explain the switch between time and light controlling of solar street lights to the user; 5. Explain the operation method of charging and discharging controllers to the user; 6. Explain the switch of automatic/manual operation mode of PV pumps to the user; 7. Explain the parameter setting for the pump frequency converter tot eh user; 8. Explain the operation method of the off-grid system under different loads to the user;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare the User Manual; 1.2 Make users learn to operate the remote controller for solar street lights; 1.3 Make users learn to switch the time-controlled/light-controlled operation mode for solar street lights; 1.4 Make users learn to view/set parameters of the charging and discharging controller; 1.5 Make users learn to switch the operation modes for PV pumps; 1.6 Make users learn to switch the operation modes for the off-grid system; 1.7 Make users learn the input/exit of the grid-connection PV system; 1.8 Make users learn to view/set parameters of the grid-connection inverter. **2.0 Principle** The person performing this task must be able to explain the following principles:

9. Explain the grid-connection and exit of the PV system to the user; 10. Explain the operation interface and operation method of the grid-connection inverter to the user; 11. Explain the use of the monitoring APP or computer monitoring client to the user; 12. Explain how to view the system efficiency and generating capacity data to the user.	2.1 Basic principle of preparing User Manual; 2.2 Working principle of MPPT; 2.3 Working principle of the grid-connection inverter; 2.4 Working principle of the off-grid inverter. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Operation modes of equipment under different scenarios; 3.2 Theory of calculating the installed capacity and generating capacity; 3.3 Theory of calculating the load power and power consumption. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	A full set of equipment and spare parts will be handed over to the user as per the list; the content in the part of "Operation and Normal Operation of the System" in the User Manual will be prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	HANDING OVER EQUIPMENT	**DUTY NO.**	404
TASK TITLE	EXPLAINING DAILY MAINTENANCE OF THE SYSTEM TO THE USERS	**TASK NO.**	4042
PERFORMANCE CRITERIA	The person performing this task must be able to explain the method of daily maintenance for ths system to the users.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Remote controllers for solar street lights; 2. Smartphone (with pre-installed APP for product monitoring); 3. Laptop (with pre-installed client for product monitoring); 4. Digital multimeter; 5. Clamp ammeter; 6. Universal tool kits for electricians; 7. MC4 tool kits.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Explain the daily maintenance of the system to the users at the construction site; 2. Create PPTs to explain the daily maintenance of the system to the users; 3. Explain the orientation and dip angle of the PV modules to the users; 4. Explain the appearance inspection and cleaning of the PV modules to the users; 5. Explain the maintenance measures for solar street lights to the users; 6. Explain the maintenance measures for PV pumps to the users; 7. Explain the maintenance measures for battery packs to the users; 8. Explain the maintenance measures for solar controllers to	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare the User Manual; 1.2 Make the users learn to adjust the orientation and dip angle of PV modules; 1.3 Make the users learn to inspect the appearance of PV modules; 1.4 Make the users learn to clean PV module in accordance with apecifications; 1.5 Make the users learn to maintain battery packs; 1.6 Make the users learn to maintain grid-connection inverters; 1.7 Make the users learn to maintain AC/DC distribution boxes; 1.8 Make the users learn to maintain off-grid inverters; **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principle of preparing User Manual; 2.2 Basic principle of PV power generation; 2.3 Working principle of the grid-connection inverter;

the users; 9. Explain the maintenance measures for grid-connection inverters to the users; 10. Explain the maintenance measures for charging and discharging controllers to the users; 11. Explain the maintenance measures for AC/DC distribution boxes to the users; 12. Explain the maintenance measures for off-grid inverters to the users;	2.4 Working principle of the off-grid inverter; **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Theory of orientation, dip angle and blocking affecting the power generation efficiency of PV modules; 3.2 Theory of charge and discharge depth affecting the service life of batteries; 3.3 Theory of calculating the load power and power consumption. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The content of the part of "Daily Maintenance of the System" in the User Manual will be prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** **1.** Safety consciousness; **2.** Hazardous source identification; **3.** Occupational health knowledge; **4.** Economization and environmental protection knowledge.

OCCUPATION	RENEWABLE ENERGY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	HANDING OVER EQUIPMENT	**DUTY NO.**	404
TASK TITLE	EXPLAINING THE TROUBLESHOOTING OF COMMON FAILURES OF THE SYSTEM AND THE SAFETY PRECAUTIONS TO THE USERS	**TASK NO.**	4043
PERFORMANCE CRITERIA	The person performing this task must be able to troubleshoot the common failures of the system and explain the troubleshooting methods and safety precautions to the users.		
RANGE STATEMENT	The task can be performed on the construction site under the supervision of a Senior Technician or Renewable Energy Engineer. The tools and equipment to be used include: 1. Remote controllers for solar street lights; 2. Smartphone (with pre-installed APP for product monitoring); 3. Laptop (with pre-installed client for product monitoring); 4. Digital multimeter; 5. Clamp ammeter; 6. Universal tool kits for electricians; 7. MC4 tool kits.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Explain the troubleshooting process and safety precautions for the equipment to the users at the construction site; 2. Create PPTs to explain the troubleshooting process and safety precautions for the equipment to the users; 3. Cite cases to explain the troubleshooting process and safety precautions for the equipment to the users; 4. Explain the troubleshooting process for PV modules/clusters to the users; 5. Explain the troubleshooting process of solar street lights to the users; 6. Explain the troubleshooting process for PV pumps to the users;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare the User Manual; 1.2 Make the users master the safety Precautions for the equipment; 1.3 Make the users learn to troubleshoot the PV modules/clusters; 1.4 Make the users learn to troubleshoot the solar street lights; 1.5 Make the users learn to troubleshoot the PV pumps; 1.6 Make the users learn to troubleshoot the small grid-connection/off-grid PV generation system; 1.7 Make the users learn to use the supporting tools and instruments. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principle of preparing User Manual; 2.2 Causes and the principle of burnout of PV modules and

7. Explain the troubleshooting process for the small grid-connection/off-grid PV generation system to the users; 8. Explain the use methods of supporting tools and instruments to the users.	connectors; 2.3 Principle of identifying danger sources; 2.4 Principle of leakage protection. **3.0 Theories** The person performing this task must be able to explain the following contents: 3.1 Main factors causing failures of PV modules; 3.2 Main factors causing the alarm failure of inverters. **4.0 Essential Skills** 4.1 "6S" occupational quality; 4.2 Communication and teamwork skills; 4.3 Self-learning ability; 4.4 Innovative spirit; 4.5 Copywriting ability; 4.6 Basic computer skills. **5.0 Math Skills** 5.1 Basic computing skills; 5.2 Measurement and unit conversion; 5.3 Geometry knowledge; 5.4 Calculation of common trigonometric functions.
DESCRIPTION OF THE END PRODUCT / SERVICE	The content of the part of "Guide for Troubleshooting and Safety Precaution" in the *User Manual* will be prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety consciousness; 2. Hazardous source identification; 3. Occupational health knowledge; 4. Economization and environmental protection knowledge.

TABLE 1: DACUM CHARTS FOR RENEWABLE ENERGY ENGINEERING TECHNICIAN - NTA 4

DUTIES	TASKS	ENABLERS
1.0 Equipment selection and material accounting for the small PV system	1.1 Equipment selection and material accounting for solar street lights. 1.2 Equipment selection and material accounting for PV pumps. 1.3 Equipment selection and material accounting for the small off-grid PV generation system. 1.4 Equipment selection and material accounting for the small grid-connection PV generation system.	**Generic skills and knowledge** · Reading the system principle diagrams · Reading the installation drawings of the system · Knowledge and skills of the main equipment used for PV power generation · Basic mathematics knowledge · Measurement and data processing · Basic computer skills · Communication and team cooperation skills **Tools and equipment** · Steel tape, steel ruler · Distance measuring instrument · Level ruler · Level gauge **Materials** · PV modules, supports, charging and discharging controllers, batteries, inverters, load equipment, distribution boxes, etc. **Requirements for employees** · "6S" professional quality · Communication and team cooperation ability · Economization and environmental protection consciousness · Standard consciousness · Occupational health and safety consciousness
2.0 Equipment installation and electrical connections for the small PV system	2.1 Construction of foundation and support components. 2.2 Installation of PV module. 2.3 Device installation and electrical connection.	**Generic skills and knowledge** · Reading the system principle diagrams · Read the installation drawings of the system · Knowledge and skills of the main equipment used for PV power

DUTIES	TASKS	ENABLERS
		generation · Basic mathematics knowledge · Measurement and data processing · Basic computer skills · Communication and teamwork skills **Tools and equipment** · Steel tapes, distance measuring instruments, level gauges; · Clamp ammeter, digital multimeter, insulation resistance meter · Universal tool kits for electricians; · Wrench & socket kits, inner hexagon wrench kits, monkey wrenches · MC4 tool kits · Wire strippers, press pliers, diagonal pliers, needle-nose pliers · Safety helmets, insulating gloves, insulating boots, temporary blocks, seat belts, insulation ladders, climbers **Materials** · Materials for foundations and support components, PV modules, supports, charging and discharging controllers, batteries, inverters, load equipment, distribution boxes, AC/DC cables, auxiliary materials for equipment installation, etc. **Requirements for employees** · "6S" professional quality · Communication and team cooperation ability · Economization and environmental protection consciousness · Honesty and service consciousness · Standard consciousness · Ability of self-learning · Innovative spirit · Occupational health and safety consciousness

DUTIES	TASKS	ENABLERS
3.0 Setting of the operation mode and parameters for the small PV system	3.1 Setting of the operation mode and parameters for the solar street lights. 3.2 Setting of the operation mode and parameters for PV pumps. 3.3 Setting of the operation mode and parameters for the small off-grid PV generation system. 3.4 Setting of the operation mode and parameters for the small grid-connection PV generation system.	**Generic skills and knowledge** · Reading User Manual and instructions · Knowledge and skills of the main equipment used for PV power generation · Basic computer skills · Communication and teamwork skills **Tools and equipment** · Digital multimeter · Clamp ammeter · Insulation resistance meter · Smartphone (with pre-installed APP for product monitoring) · Laptop (with pre-installed client for product monitoring) · Universal tool kits for electricians; · MC4 tool kits **Materials** · Remote controllers, APP for equipment mornitoring and computer client **Requirements for employees** · "6S" professional quality · Honesty and service consciousness · Standard consciousness · Ability of self-learning · Innovative spirit · Occupational health and safety consciousness

DUTIES	TASKS	ENABLERS
4.0 Handing over equipment	4.1 Explaining the operation and running of the system to the users. 4.2 Explaining daily maintenance of the system to the users. 4.3 Explaining the troubleshooting of common failures of the system and the safety precautions to the users.	**Generic skills and knowledge** · Reading User Manual and instructions · Knowledge and skills of the main equipment used for PV power generation · Basic computer skills · Communication and teamwork skills **Tools and equipment** · Remote controllers for solar street lights · Smartphone (with pre-installed APP for product monitoring) · Laptop (with pre-installed client for product monitoring) · Digital multimeter · Clamp ammeter · Universal tool kits for electricians; · MC4 tool kits **Materials** · User Manual (product instructions), equipment list, spare parts for products, supporting tools **Requirements for employees** · "6S" professional quality · Communication and team cooperation ability · Economization and environmental protection consciousness · Honesty and service consciousness · Copywriting ability · Occupational health and safety consciousness