worldskills

Technical Description

Renewable Energy

Skill 62

WorldSkills International, by a resolution of the Competitions Committee and in accordance with the Constitution, the Standing Orders, and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

1 Introduction

1.1 Name and description of the skill competition

1.1.1 The name of the skill competition is

Renewable Energy

1.1.2 Description of the associated work role(s) or occupation(s)

Across the world, there is an increasingly urgent search for renewable sources of energy to add to or replace non-renewable sources. This search is driven by climate change, the adverse environmental impact of non-renewable sources, a lack of energy supply, and financial cost.

Therefore, traditional and new entrants to the energy market are striving to optimise energy production from renewable sources, and thus to reduce environmental strain and production costs. Renewable energy is harnessed from different sources such as wind, water (hydroelectric), solar (photovoltaic effect), organic matter (biomass) and the earth's core heat (geothermal).

Within this fast-growing sector, while engineers focus on the design of systems for sustainability and efficiency, the renewable energy technician has the responsibility to ensure the efficient operation of equipment that collects, generates, or distributes power from renewable energy sources. Depending on their capability, although the renewable energy technician does not design all renewable energy systems' capacities, they may design sub-systems for the installations that they then complete, commission, maintain, and optimize.

The renewable energy technician's environment is challenging, requiring both technical and non-technical skills. Working indoors and outdoors, they can face adverse conditions including heights, inclement weather, and remote locations, requiring close attention to health and safety legislation. Furthermore, technicians must have the strength to lift heavy equipment and the manual dexterity to handle power tools. These challenges relate particularly, but not entirely, to the installation, integration, commissioning, and maintenance of the structures and equipment for generating and collecting energy sources.

The technician must also be prepared to work individually or in teams, at residential, commercial or industrial locations, and with diverse types of customers, on small or major projects. To work at the leading edge of renewable energy, these are the defining professional skills for a successful renewable energy technician:

- Perceptiveness and problem-solving skills to quickly identify and resolve issues, large and small
- Complex data and information handling
- Visualization and forethought to steer modifications
- Detailed working knowledge of tools, procedures, and standards
- Resilience to deal with rapid and often disruptive change
- Capacity to harness and optimize the impacts of new technologies

Renewable energy technicians tend to have experience and skills in two or more forms of renewable energy. However, as technology and supply grow, their role and focus will broaden to follow consumer choice and demand based on location, availability, need, and price. The ability to grow technically and professionally, in line with the development of the sector, will mark out the future exceptional renewable energy technician.

1.1.3 Number of Competitors per team

Renewable Energy is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The Competitors must not be older than 22 years in the year of the Competition.

1.2 The relevance and significance of this document

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods, and procedures that govern the competition.

Every Expert and Competitor must know and understand this Technical Description.

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 Associated documents

Since this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI – Code of Ethics and Conduct
- WSI – Competition Rules
- WSI – WorldSkills Occupational Standards framework
- WSI – WorldSkills Assessment Strategy
- WSI online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations
- WorldSkills Standards and Assessment Guide (skill-specific)

2 The WorldSkills Occupational Standards (WSOS)

2.1 General notes on the WSOS

The WSOS specifies the knowledge, understanding, skills, and capabilities that underpin international best practice in technical and vocational performance. These are both specific to an occupational role and also transversal. Together they should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, to the extent that it can. The Standard is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the “weighting”. The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills and capabilities that are set out in the WorldSkills Occupational Standards. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, if this does not distort the weightings assigned by the Standards.

2.2 WorldSkills Occupational Standards

Section		Relative importance (%)
1	**Work organization and management**	**5**
	The individual needs to know and understand: • Health and safety legislation, obligations, and documentation • Safety procedures when working with electricity • The situations when personal protective equipment (PPE) must be used • The purposes, uses, care, maintenance, and storage of all tools and equipment together with their safety implications • The purposes, uses, care, and storage of materials • The importance of keeping a tidy work area • Sustainability measures applying to the use of ‘green’ materials and recycling	

Section		Relative importance (%)
	• The importance of reducing carbon footprints during project implementation • The ways in which working practices can minimize wastage and help to manage costs whilst maintaining quality • The principles of workflow and measurement • The significance of planning, accuracy, checking, and attention to detail in all working practices • The importance of cyber security in energy management systems.	
	The individual shall be able to: • Develop and follow health, safety, environment standards, rules, and regulations • Diligently follow electrical safety procedures • Identify and use the appropriate personal protective equipment (PPE) including safety footwear, ear, and eye protection • Select, use, clean, maintain, and store all tools and equipment safely • Select, use, and store all materials safely • Identify and take care of expensive fixtures/fittings • Plan the work area to maximize efficiency and maintain the discipline of regular tidying • Measure accurately • Manage time effectively • Work efficiently and check progress and outcomes regularly • Establish and consistently maintain high quality standards and working processes.	
2	**Communication and interpersonal skills**	**5**
	The individual needs to know and understand: • The significance of establishing and maintaining customer confidence and trust • The importance of maintaining and keeping knowledge base up to date • The roles and requirements of related trades • The value of building and maintaining productive working relationships • Techniques of effective teamwork • The importance of rapidly resolving misunderstandings and conflicting demands	
	The individual shall be able to: • Interpret customer requirements and positively manage customer expectations • Provide advice and guidance on products/solutions, including technological advancements	

Section		Relative importance (%)
	• Visualize and translate customer wishes, making recommendations which meet/improve their design and budget requirements • Question customers closely/deeply to fully understand requirements • Introduce related trades to support customer requirements • Use digital systems to support communications • Provide clear instructions • Produce written reports for customers and the organization • Produce cost and time estimates for customers • Recognize and adapt to the changing needs of related trades • Work effectively as a member of a team	
3	**Problem solving, innovation, and creativity**	**10**
	The individual needs to know and understand: • Common types of problems that may occur in the work process • Diagnostic troubleshooting approaches • Industry developments including new technologies, standards and working methods, e.g., energy source, capture and storage systems • Emerging trends such as AI driven energy systems, floating solar installations and hybrid renewable setups • Potential problems with providers and alternate solutions • The impact of new technology (installation methods and equipment and products)	
	The individual shall be able to: • Check work regularly to minimize problems at a later stage • Identify problems originating from a related trade • Identify incorrect information to prevent problems • Recognize and understand problems quickly and follow a self-managed process for resolve them • Recognize opportunities to contribute to improve the solution and overall customer satisfaction level • Demonstrate willingness to try new methods and embrace change • Implement new installation technologies and techniques to improve productivity, quality of installation, and energy generation capabilities	
4	**Planning and design**	**15**
	The individual needs to know and understand: • Different types of standards, drawings, installation descriptions, and manuals • Different types of materials and installation techniques to be used in different environments	

Section		Relative importance (%)
	• Different design software available in the market and the main products used by design teams • Customers' requirements to meet their generation needs • The value and uses of energy potential charts for different renewable energies sources i.e., hybrid systems, photovoltaic and wind power and energy and storage • Local standards and specifications for installation and grid connection	
	The individual shall be able to: • Choose the most suitable renewable energy source according to customer needs and local characteristics • Design and develop renewable energy systems for Grid-Tie projects, connected to the electrical grid, or Off-Ggrid projects, independent of the grid • Check systems meet customer energy generation needs, adhere to applicable local standards, and incorporate storage solutions where necessary, ensuring flexibility for diverse global requirements • Use design software accordingly to the chosen renewable energy source • Create the required documentation and drawings according to the local standards and government and utilities' requirements • Read, interpret, and revise drawings and documentation, including: ◦ Layout and electrical drawings ◦ Written instructions • Plan activities using drawings and documentation provided	
5	**Installation**	**20**
	The individual needs to know and understand: • Different mechanical and electrical technical solutions for assembly structures • Engineering plant layout, SLD, building/ land drawings/blueprints, schematics, and manufacturers' manuals • International and locally applicable standards and regulations for safety procedures related to installation • Local and applicable international standards related to the required configuration of generation that will be connected to the electrical grid • Specification and installation techniques related to PV panels and wind generators • The difference in specification, equipment, and installation for grid, tie, and off grid systems, and configuration of the equipment to improve their functionality and generation capabilities	

Section		Relative importance (%)
	The individual shall be able to: • Install equipment and cable lines supplied drawings and documentation • Connect equipment as per provided instructions and current industry standards and regulations • Identify equipment and correct installations, comparing Grid Tie (connected to the electrical grid) and Off Grid (not connected to the electrical grid) systems • Set configurations for PV and Wind Inverters to connect systems to local electric grids • Connect renewable energies generators to local electrical grids • Perform the interface, integration of sensors, components and renewable energy monitoring systems • Define solutions according to customer demand and load profile • Implement solutions according to customer demand and load profile	
6	**Operation, testing. commissioning, and reporting**	**25**
	The individual needs to know and understand: • Industrial regulations and standards applicable to different types of installations • Verification standards, methods, and reports to be used to record verification results • Types of measuring instruments • Tools and software used for integration, and operation, parameterization, programming, and commissioning • The correct operation of the electrical installation in accordance with planned specifications and customer requirements	
	The individual shall be able to: • Test installations before energizing to ensure personal, electrical, and mechanical safety • Test installations when energized by checking complete function on all equipment installed to ensure correct operation of new, repaired or refurbished installation, as per instructions • Set installations to fully functioning and ensure operators can safely, effectively, and efficiently perform required functions to meet customer/employer satisfaction • Set installations to fully functioning according to design parameters • Advise and assist customers for proper operation and maintenance procedures • Compile test results data and complete detailed commissioning reports, including recommendations on optimization	

Section		Relative importance (%)
7	**Maintenance, fault-finding, and repair**	**20**
	The individual needs to know and understand: • Different types of installations and equipment for specific environments • Different generations of installations and equipment • The purpose of a specific installation and equipment • The customers' needs for various functions of installation and equipment • Different measuring and control equipment used to verify and ensure the restoration of the proper functioning of the system • Market developments about new technologies applied to renewable energies • Legislation and best practices for: ◦ Sustainability ◦ Waste disposal and recycling.	
	The individual shall be able to: • Adapt to changing circumstances • Disassemble equipment for maintenance and/or repair • Troubleshoot electrical faults, mechanical and structural installations • Use, test and calibrate measuring and diagnose equipment to find and locate faults during regular maintenance and troubleshooting actions • Verify if existing installations and equipment still meets current standards and design parameters • Repair or replace worn, damaged or defective installation parts or equipment • Propose actions to prevent recurrence of defects • Propose and implement changes (equipment or processes) to optimize and or upgrade existing systems in order to enhance system's work and/or operation.	
	Total	**100**

3 The Assessment Strategy and Specification

3.1 General guidance

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

Expert assessment practice lies at the heart of the WorldSkills Competition. For this reason, it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the WorldSkills Competition falls into two broad types: Measurement and Judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards. The Test Project is the assessment vehicle for the skill competition, and therefore also follows the Standards. The CIS enables the timely and accurate recording of marks; its capacity for scrutiny, support, and feedback is continuously expanding.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed, developed, and verified through an iterative process, to ensure that both together optimize their relationship with the Standards and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, to demonstrate their quality and conformity with the Standards.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors for quality assurance and to benefit from the capabilities of the CIS.

4 Assessment Design and Practice

4.1 General guidance

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors' work as demonstrated through the Test Project, and the procedures and requirements for marking.

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standard that represents each skill competition, which itself represents a global occupation. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards.

By reflecting the weightings in the Standards, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill competition and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards, if there is no practicable alternative.

For integrity and fairness, the Marking Scheme and Test Project are increasingly designed and developed by one or more Independent Test Project Designer(s) with relevant expertise. In these instances, the Marking Scheme and Test Project are unseen by Experts until immediately before the start of the skill competition, or competition module. Where the detailed and final Marking Scheme and Test Project are designed by Experts, they must be approved by the whole Expert group prior to submission for independent validation and quality assurance. Please see the Competition Rules for further details.

Experts and Independent Test Project Designers are required to submit their Marking Schemes and Test Projects for review, verification, and validation well in advance of completion. They are also expected to work with their Skill Advisor, reviewers, and verifiers, throughout the design and development process, for quality assurance and in order to take full advantage of the CIS's features.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition. Skill Advisors actively facilitate this process.

4.2 Assessment Criteria

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards.

Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). **The Assessment Criteria, the allocation of marks, and the assessment methods, should not be set out within this Technical Description. This is because the Criteria, allocation of marks, and assessment**

methods all depend on the nature of the Marking Scheme and Test Project, which is decided after this Technical Description is published.

The Mark Summary Form generated by the CIS will comprise a list of the Assessment Criteria and Sub Criteria.

The marks allocated to each Criterion will be calculated by the CIS. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

4.3 Sub Criteria

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by Measurement or Judgement, or both Measurement and Judgement.

Each marking form (Sub Criterion) specifies both the day on which it will be marked, and the identity of the marking team.

4.4 Aspects

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by Measurement or by Judgement.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

		CRITERIA								TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE
		A	B	C	D	E	F	G	H			
STANDARDS SPECIFICATION SECTION	1	5.00								5.00	5.00	0.00
	2		2.00					7.50		9.50	10.00	0.50
	3								11.00	11.00	10.00	1.00
	4			5.00						5.00	5.00	0.00
	5				10.00	10.00	10.00			30.00	30.00	0.00
	6		8.00	5.00				2.50	9.00	24.50	25.00	0.50
	7			10.00				5.00		15.00	15.00	0.00
TOTAL MARKS		5.00	10.00	20.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00

4.5 Assessment and marking

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by Judgement, Measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (Section 4.6 refers.)

4.6 Assessment and marking using Judgement

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, Judgement must be conducted using:

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts, or separate guidance notes). This is documented in the Standards and Assessment Guide.
- the 0-3 scale to indicate:
  - 0: performance below industry standard
  - 1: performance meets industry standard
  - 2: performance meets and, in specific respects, exceeds industry standard
  - 3: performance wholly exceeds industry standard and is judged as excellent

Three Experts will judge each Aspect, normally simultaneously, and record their scores. A fourth Expert coordinates and supervises the scoring, and checks their validity. They also act as a judge when required to prevent compatriot marking.

4.7 Assessment and marking using Measurement

Normally three Experts will be used to assess each Aspect, with a fourth Expert supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

4.8 The use of Measurement and Judgement

Decisions regarding the choice of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

4.9 Skill assessment strategy and procedures

WorldSkills is committed to continuous improvement including reviewing past limitations and building on good practice. The following skill assessment strategy and procedures for this skill competition take this into account and explain how the marking process will be managed.

- Each Aspect describes in detail one of the estimated indicators, as well as possible assessments or instructions for judgement marking.
- The Marking Scheme lists in detail each aspect for which a mark is made, along with the number of marks assigned to it.
- The number of marks awarded for each Aspect should fall within the range of marks defined for each section of the WSOS. It will be displayed in the CIS score distribution table, in the following format.

There is daily marking. Each Sub Criterion is marked on a daily basis. Subject to their expertise, the rules and quality requirements, there is a reasonable balance of marking by each Expert.

Each Test Project module will rigorously sample the relevant standards. The assessment criteria will largely or entirely follow the sections of the WorldSkills Occupational Standards.

Marking Day Schedule

Section	Criterion	Module	Day (approx.)	Min. test groups
A	Safety and ESG practices	All modules	C1,C2,C3,C4	2
B	Installation of equipment	1,2,4	C1,C2,C3,C4	2
C	Maintenance of energy systems	2,4,6	C1,C2	2
D	Designs and simulations	5,7	C3,C4	2
E	Test and commissioning	1,2,3,4,7	C1,C2,C3,C4	2
F	Inspections and reports	All modules	C1,C2,C3,C4	2
G	Operation systems	3,4,7	C1,C2,C4	2

5 The Test Project

5.1 General notes

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the applied knowledge, skills, and behaviours set out in each section of the WSOS.

The purpose of the Test Project is to provide full, balanced, and authentic opportunities for assessment and marking across the Standards, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme, and Standards will be a key indicator of quality, as will be its relationship with actual work performance.

The Test Project will not cover areas outside the Standards or affect the balance of marks within the Standards other than in the circumstances indicated by Section 2. This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards. Section 2.1 refers.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work. The Test Project will not assess knowledge of WorldSkills rules and regulations.

Most Test Projects and Marking Schemes are now designed and developed independently of the Experts. They are designed and developed either by the Skill Competition Manager, or an Independent Test Project Designer, normally from C-12 months. They are subject to independent review, verification, and validation. (Section 4.1 refers.)

The information provided below will be subject to what is known at the time of completing this Technical Description, and the requirement for confidentiality.

Please refer to the current version of the Competition Rules for further details.

5.2 Format/structure of the Test Project

The Test Project is a series of seven (7) standalone modules.

- Module 1 – Installation of PV plant
- Module 2 – Installation of wind turbine and storage systems
- Module 3 – Mechanical maintenance Renewable Energy system
- Module 4 – Electrical maintenance Renewable Energy system
- Module 5 – Renewable energy systems design
- Module 6 – Inspection and fault detection
- Module 7 – Integration and operation of energy systems

5.3 Test Project design requirements

Test Projects should reflect the purposes, structures, processes, and outcomes of the occupational role they are based on. They should aim to be a small-scale version of that role. Before focusing on practicalities, SMTs should show how the Test Project design will provide full, balanced, and authentic opportunities for assessment and marking across the Standards, as set out in Section 5.1.

General requirements

The main objective of this test project is to demonstrate, in a practical way, the diverse roles of a renewable energy professional. This professional will face complex challenges in scenarios involving equipment with technologies designed for the production and conservation of green energy.

In this context, the previously trained competitor must perform tasks divided into modules that represent practices used in the industry, along with their respective international performance standards, local safety regulations, and ESG (Environmental, Social, and Governance) best practices. However, the competitor's performance will be assessed according to these requirements and rules.

Test Project to be designed by an Independent Test Project Designer ideally from an industry sponsor to reflect current and upcoming technologies.

The Test Project will consist of the following series of seven (7) modules.

Module	Name	Hours (approx)	Standalone	Place
1	Installation of PV plant	3	√	In the Competitor's work area
2	Installation of wind turbines and storage systems	3	√	In the Competitor's work area
3	Mechanical maintenance Renewable Energy system	2	√	In the specific area shared and work rotation
4	Electrical maintenance Renewable Energy system	2	√	In the specific area shared and work rotation
5	Renewable energies plants systems design	2	√	In the Competitor's work area
6	Inspection and fault detection	2	√	In the specific area shared and work rotation
7	Integration and operation of energy systems	4	√	In the Competitor's work area
	Total	18		

Note: All modules can be applied on any of the days.

Module 1 – Installation of PV plant

The Competitor shall execute the installation of a photovoltaic plant in compliance with the supplied infrastructure, tools, and execution design.

Module 2 – Installation of wind turbine and storage systems

The Competitor shall execute the installation of a wind turbine and a storage system that may or may not be connected, the project may require the mechanical assembly of the wind turbine, assembly of battery banks and their AC and DC electrical connections carried outing compliance with the supplied infrastructure, tools, data sheets and execution design.

Module 3 – Mechanical maintenance Renewable Energy system

This module will submit the competitor to a mechanical maintenance activity on specific equipment in a previously prepared environment that simulates failure situations, where he must carry out the maintenance procedures according to the manufacturer's instructions and requirements. It will provide the resources available on the desktop such as tools, supplies, instruments, manuals and forms.

Module 4 – Electrical maintenance Renewable Energy system

This module will submit the competitor to an electrical maintenance activity on specific equipment in a previously prepared environment that simulates failure situations, where he must perform maintenance procedures according to the manufacturer's instructions and requirements. It will provide the resources available on the desktop such as tools, supplies, instruments, manuals and forms.

Module 5 – Renewable energies plants systems design

The Competitor will design renewable energy systems, in this module he will use the computer of his work environment for the use of specific software for example: simulation of wind systems, solar PV, 3D modeling, executive projects, diagrams and reports. The executive project to be delivered must follow requirements such as: equipment specifications, potential energy generation according to the initial requirement, reduction of CO2 emissions, total installation cost and financial evaluation (Payback, IRR, DSCR, ROI); Use design software according to the selected renewable energy source (suggestions: PV SYST/Helioscope, Auto Cad Electrical, Wind Pro, Google Earth for system design and home-pro for hybrid systems);

Module 6 – Inspection and fault detection

The Competitor must perform a visual inspection of the photovoltaic panels and/or installed wind turbines, using UAVs (Unmanned Aerial Vehicle), thermographic analysis camera and specific reporting software. They must perform tests with specific instruments to detect non-destructive electrical faults in: cables, connections, components, equipment parameters and complete systems. A maximum of 10 defects can be installed between visual and electrical such as: (high grounding resistance, low insulation resistance, incorrect polarity, incorrect identification, cracks in solar panels, rust in metal parts, incorrect assemblies, incorrect configuration of component parameters, high temperature in photovoltaic panels, incorrect converter settings, incorrect overload settings, short circuit, open circuit. Test instruments must meet the Health, Safety and Environment requirements of the Host Country.

Module 7 – Integration and operation of renewable energy systems

The Competitor will carry out the integration of the different types of generating sources previously installed as in a real industry. The integration will be carried out using an integration system with connection, measurement, protective equipment, control and management of priority energies according to their greater relevance of operation and cost. They must make electrical connections, equipment communication and software parameterization, according to data from scenarios of better consumption and best efficiency according to the particularities of each generating source in view of the scenario proposed in the project.

5.4 Test Project coordination and development

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

5.4.1 Test Project coordination (preparation for Competition)

Coordination of the Test Project/modules will be undertaken by the Skill Competition Manager.

5.4.2 Who develops the Test Project/modules

The Test Project/modules are developed by an Independent Test Project Designer (ITPD) in collaboration with the Skill Competition Manager.

5.4.3 When is the Test Project developed

The Test Project/modules are developed according to the following timeline:

Time	Action
Fifteen (15) months prior to the Competition	The ITPD is identified and a Confidentiality Agreement between WSI and the ITPD is organized.
Two (2) months prior to the Competition	The Test Project documents are sent to the WorldSkills International Skills Competitions Administration Manager.
At the Competition on C-3	The Test Project/modules are presented to the Experts without any technical information.
At the Competition every morning of each Competition Day	The full Test Project/modules are presented to Competitors.

5.5 Test Project initial review and verification

The purpose of a Test Project is to create a challenge for Competitors which authentically represents working life for an outstanding practitioner in an identified occupation. By doing this, the Test Project will apply the Marking Scheme and fully represent the WSOS. In this way it is unique in its context, purpose, activities, and expectations.

To support Test Project design and development, a rigorous quality assurance and design process is in place (Competition Rules sections 10.6-10.7 refer.) Once approved by WorldSkills, the Independent Test Project Designer (ITPD) is expected to identify one or more independent expert(s), and trusted individuals initially to review the Independent Test Project Designer's ideas and plans, and subsequently to verify the Test Project, prior to validation.

A Skill Advisor will ensure and coordinate this arrangement, to guarantee the timeliness and thoroughness of both initial review, and verification, based on the risk analysis that underpins Section 10.7 of the Competition Rules.

5.6 Test Project validation

The Skill Competition Manager coordinates the validation of the Test Project/modules and will ensure that it can be completed within the material, equipment, knowledge, and time constraints of Competitors.

5.7 Test Project circulation

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Experts on C-3 and to Competitors every morning of each Competition Day.

5.8 Test Project change

Due to the Test Project being developed by an Independent Test Project Designer (ITPD), there is no change required to be made to the Test Project/modules at the Competition. Exceptions are amendments to technical errors in the Test Project documents and according to infrastructure limitations.

5.9 Material or manufacturer specifications

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre. However, note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

6 Skill management and communication

6.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the WorldSkills skill-specific Discussion Forum. (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the WorldSkills Discussion Forum. The Chief Expert (or an Expert Lead appointed by the Skill Management Team) will be the moderator for this Discussion Forum. Refer to the Competition Rules for the timeline of communication and competition development requirements.

6.2 Competitor information

All information for registered Competitors is available from the Competitor Centre (www.worldskills.org/competitorcentre).

This information includes:

- Competition Rules
- Technical Descriptions
- Mark Summary Form (where applicable)
- Test Projects (where applicable)
- Infrastructure List
- WorldSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

6.3 Test Projects and Marking Schemes

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

6.4 Day-to-day management

The day-to-day management of the skill competition during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and the Expert Leads. The Skill Management Plan is progressively developed in the six (6) months prior to the Competition and finalized at the Competition. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

6.5 General best practice procedures

General best practice procedures clearly delineate the difference between what is a best practice procedure and skill-specific rules (section 9). General best practice procedures are those where Experts and Competitors CANNOT be held accountable as a breach to the Competition Rules or skill-specific rules which would have a penalty applied as part of the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System. In some cases, general best practice procedures for Competitors may be reflected in the Marking Scheme.

Topic/task	Best practice procedure
Interpreter communication with Expert during the competition	• A Competitor must raise their hand or communication card to get the attention of an Expert other than the compatriot Expert and show to this Expert that they need help from the Interpreter. • The Expert called by the Competitor must, as quickly as possible, get the Interpreter and another neutral Expert to attend the Competitor. • Communication between an Interpreter and Competitor may only take place in the presence of a neutral Expert.
Tools used for translation	• Interpreters can use a dictionary, Internet, online tools, and translation devices to translate documents, including the Test Project. However, during the Competition, if the Interpreter is asked to help their compatriot Competitor, the Interpreter cannot use the dictionary, Internet, or translation devices in front of the Competitor. • Additionally, certain numerical values may not be shared with interpreters if the translation is taking place more than a day before the actual competition.
Tools/infrastructure	• All equipment must be handled with care and used in a professional manner. Any damage to equipment, tools, work pieces, etc. shall result in mark reductions as stated in the tasks.
Equipment failure	• If equipment or tools which are brought by the Competitor fail, no extra time will be allowed. • If equipment or tools supplied by the Competition Organizer fail, extra time will be allowed only if the Technician of the sponsor or supplying company specifies and proves it is not a “user error”.
Test Project documentation	• All Test Project documents must be stored in the Expert room in lockers by the Chief Expert.

7 Skill-specific safety requirements

7.1 Personal Protective Equipment

Refer to WorldSkills Safety Policy and Regulations for Host country or region regulations.

Task	Safety glasses with side protection	Cut-resistant gloves	Tight fitting work clothes (long trousers)	Insulated safety shoes with protective cap	Sturdy shoes with closed toe and no heel	Hearing protection	Safety Helmet/ Hard Hat
General PPE for safe areas			√	√	√		
Drilling	√	√	√	√		√	√
Sawing	√	√	√	√		√	√
General work	√		√	√			√

8 Materials and equipment

8.1 Infrastructure List

The Infrastructure List details all equipment, materials, and facilities provided by the Competition Organizer.

The Infrastructure List is available at www.worldskills.org/infrastructure.

The Infrastructure List specifies the items and quantities requested by the Skill Management Team for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

At each Competition, the Skill Management Team must review and update the Infrastructure List in preparation for the next Competition. The Skill Competition Manager must advise the Director of Skills Competitions of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition for the upcoming WorldSkills Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

8.2 Competitors toolbox

Competitors are not allowed to send a toolbox to the Competition. All tools are provided by the Competition Organizer.

8.3 Materials, equipment, and tools supplied by Competitors

It is not applicable for Competitors to bring materials, equipment, and tools to the Competition.

However, Competitors are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

8.4 Materials, equipment, and tools supplied by Experts

Experts are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

Experts are responsible that Interpreters bring their own PPE.

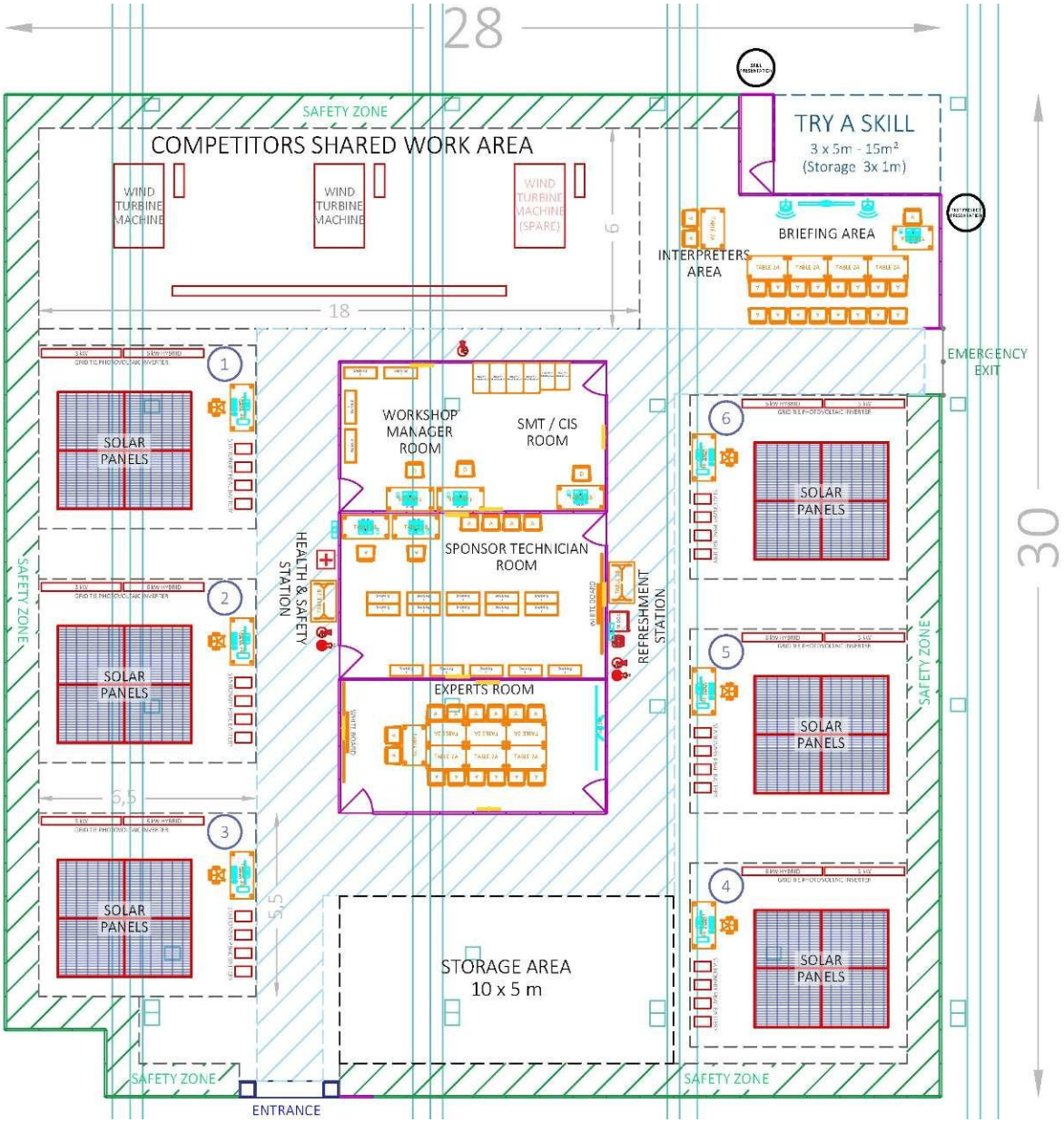
8.5 Materials and equipment prohibited in the skill area

Competitors and Experts are prohibited to bring any materials or equipment not listed in section 8.3 and section 8.4.

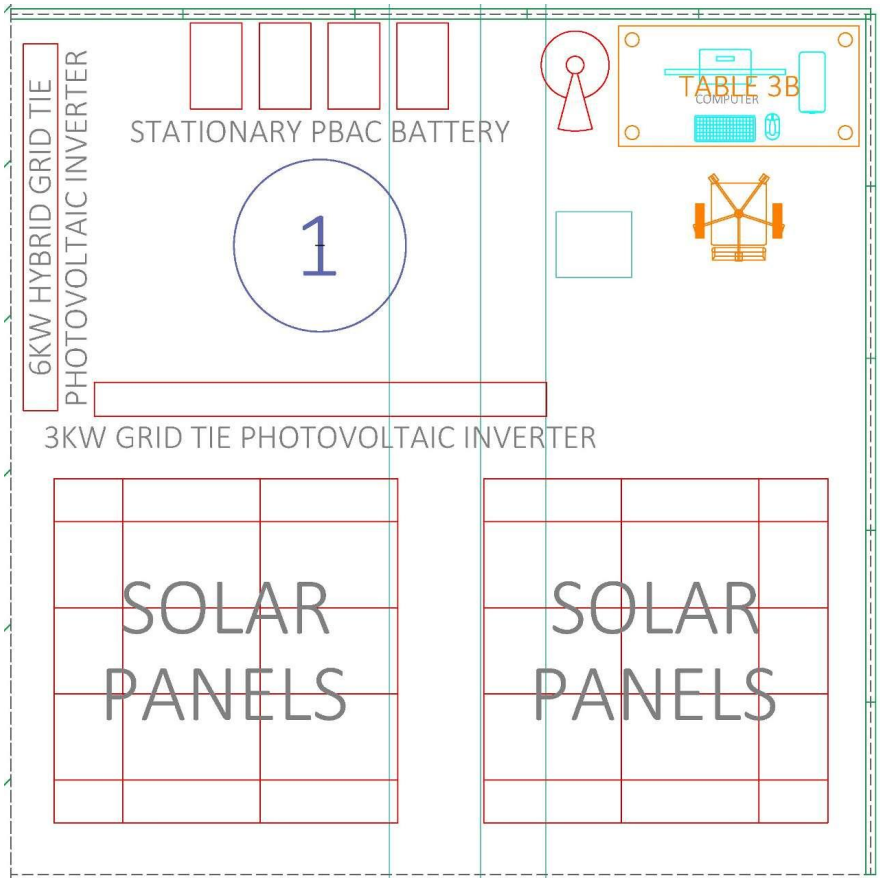
8.6 Proposed workshop and workstation layouts

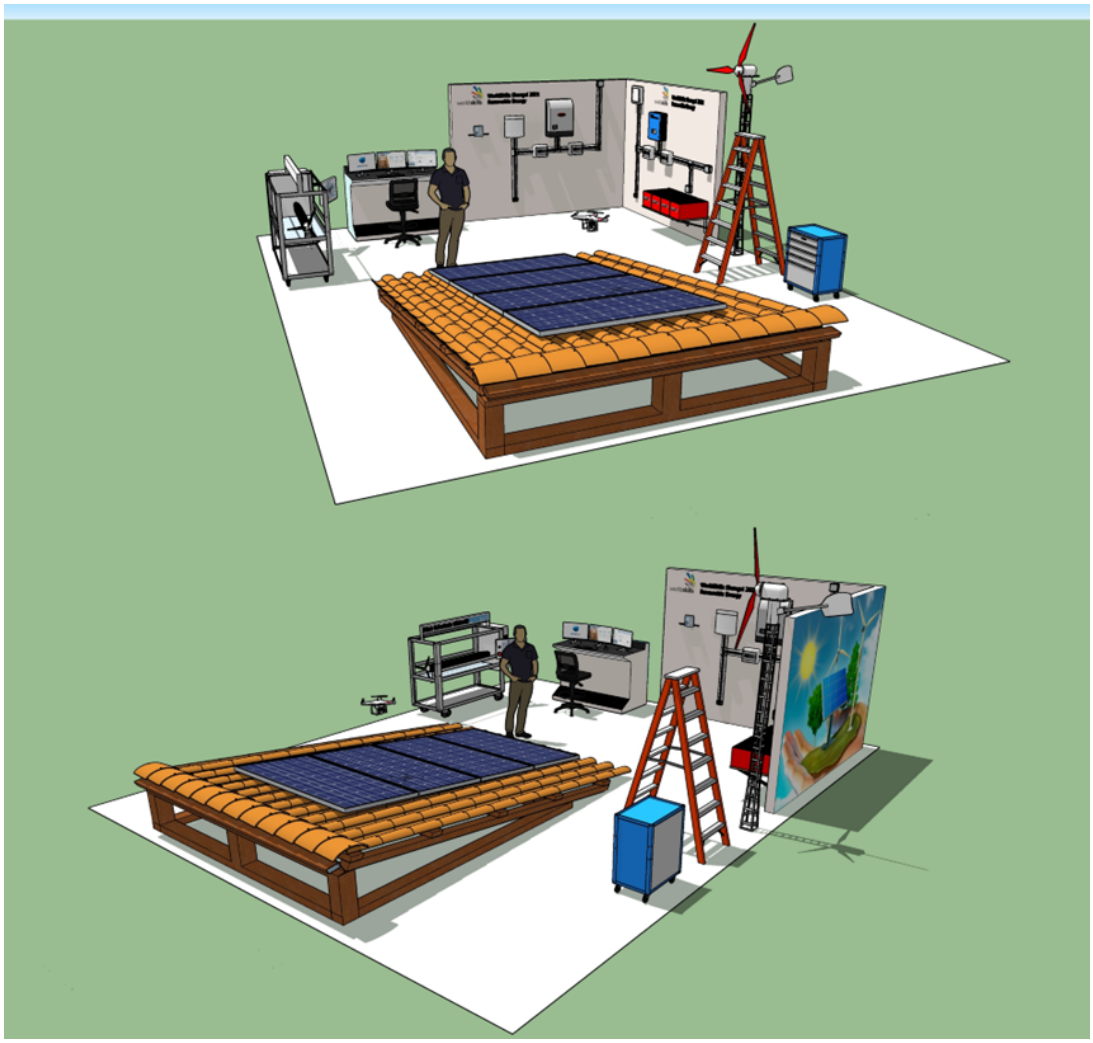
Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

Example workshop layout



Example Competitor workstation





Competition Organizer requirements

- Ensure a power supply of 230/400 V AC at each workstation;
- Ensure that necessary power supplies are available for testing;
- In indoor conditions, halogen lights must be used to simulate the operation of PV Panels.

9 Skill-specific rules

9.1 General notes

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from skill competition to skill competition. This includes but is not limited to personal IT equipment, data storage devices, Internet access, procedures and workflow, and documentation management and distribution. Breaches of these rules will be solved according to the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System.

9.2 Skill-specific rules

Topic/task	Best practice procedure
Interpreter communication with Expert during the competition	• During the competition the Interpreter is strictly not allowed to communicate with their compatriot Expert. They may only provide interpretation when requested.
Use of technology – USB, memory sticks	• Chief Expert, Experts, Interpreters, and Competitors are not allowed to bring personal memory sticks into the workshop. If these items are brought into the workshop they must be locked in the personal locker and only removed at the end of the Competition on C4. • Skill Competition Manager is exempt from this rule.
Use of technology – personal laptops, tablets, and mobile phones	• Competitors may bring tablets or mobile phones into the workshop, but they must be locked in the personal locker. They may be removed during lunch time and at the end of the Competition Day. • Skill Competition Manager, Chief Expert, Experts, and Interpreters are allowed to bring and use personal laptops, tablets, and mobile phones into the workshop.
Use of technology – personal photo and video taking devices	• Skill Competition Manager, Chief Expert, Experts, Competitors, and Interpreters are allowed to use personal photo and video taking devices in the workshop at the conclusion of the competition on C4 only.
Templates, aids, etc.	• The Competitors may bring pocket calculators to the Competition.
Assessment	• Skill Competition Manager, Chief Expert, Competitors, Experts, and Interpreters a not permitted to take paper or digital copies of the Assessment out of the workshop until the competition has finished on C4.

Topic/task	Best practice procedure
Drawings, recording information	• Competitors are not allowed to bring any prepared drawings or documented information to the Competition. • Skill competition Manager, Chief Expert, Experts, and Interpreters are allowed to bring prepared drawings or documented information to the Competition. When not in use these items must be stored in the personal locker and can only be removed at the end of each Competition day.

10 Expert knowledge and experience

10.1 Requirements

Experts appointed for this skill competition must have the following knowledge and experience for the appropriate occupation or work role as documented in **section 1.1.2**.

This section is currently under development for WSC2026.

- **Minimum formal qualification:** A degree in a relevant engineering or technology field (e.g., Electrical, Mechanical, Energy Engineering, Renewable Energy Technology) **or** an equivalent, professional certification (e.g., Energy Manager, Energy Wind, PV Installation).
- **Minimum industry experience:** At least 5 years, teaching and worked hands-on professional experience in the renewable energy sector.
- **Core technical competence:** Expertise in the design, installation, and commissioning of **photovoltaic (PV) systems**, including grid-tied, off-grid, and hybrid configurations.
- **System integration knowledge:** Experience with system balance-of-components, including inverters, charge controllers, battery storage systems, and energy monitoring platforms.
- **Safety standards:** In-depth knowledge of and practical adherence to critical **international safety standards** (e.g., IEC 62446 for PV systems, IEC 60364 for electrical installations) and safe work practices (e.g., working at heights, electrical safety).
- **Software and tools:** Competence in using industry-standard software for system design and simulation (e.g., PV*SOL, WIND Pro) and diagnostic tools (e.g., IV curve tracers, multimeters, power quality analyse, insulation testers).
- **Competition process familiarity:** Prior experience in a skills competition ecosystem (e.g., WorldSkills, EuroSkills) as a Competitor, trainer, or national Expert is **highly desirable**.
- **Judging and impartiality:** A demonstrated ability to assess work objectively against a predefined specification, remaining impartial and ethical under pressure.
- **Language and communication skills:** Professional in **English** (the official language of international competition) to effectively collaborate in a multicultural team and provide clear feedback.
- **Adaptability and collaboration:** The ability to work intensively within a diverse team of experts, adhere to strict schedules, and contribute to a consensus-based marking process.

11 Visitor and media engagement

11.1 Engagement methods

Following is a list of possible ways to maximize visitor and media engagement:

- Offer visitors two ways to recharging their mobile phones, using conventional cable method or wireless charging.
- The visitors will be provided with Contextual Knowledge about photovoltaic systems, wind power generation, hydropower generation or biogas generation.
- Display screens;
- Test Project descriptions;
- Enhanced understanding of Competitor activity;
- Competitor profiles;
- Career roadmap opportunities;
- Daily reporting of competition status;
- Benchtop prototype for photovoltaic and wind generation test system for demonstration, showing specific characteristics of renewable intermittent energy supply.

12 Sustainability

12.1 Sustainable practices

This skill competition will focus on the sustainable practices below:

- Recycling;
- Spare materials will be offered to local schools to be used in education for training purposes;
- Use of “green” materials;
- During designing of Test Projects and liaising with the current Workshop Manager, the use of “green” materials will be considered. Materials that meet the following requirements are to be used as far as possible:
- Halogen free;
- Free from toxic substances;
- Use of completed Test Projects after Competition;
- Materials that can be reused, will be offered to local schools to be used in education for training purpose. Materials that cannot be reused will be sorted as per Host Country regulations or, if meeting higher requirements, WorldSkills regulations;
- The industry partner designing the Test Project must carefully consider sustainability as a key issue;

13 References for industry consultation

13.1 General notes

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.onetonline.org/)

13.2 References

This is a broader version of Solar Thermal Energy Installers and Technicians:
https://www.onetonline.org/link/summary/47-2152.04

and a junior version of renewable energy engineer:
http://data.europa.eu/esco/occupation/0e99c929-364f-4b0a-8a64-2aab42420f00

These links also allow adjacent occupations to be explored.

ILO 3119

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Shanghai 2026.

Organization	Contact name
WindPRO	Louise Larsen, Senior Consultant

14 Appendix

14.1 Appendix information

Not applicable.