2022 BRICS Skills Competition

（BRICS Future Skills Challenge）

THCHNICAL DESCRIPTION

Renewable Energy Competition （Offline）

Content

I. Competition Name

2022 BRICS Skills Competition—Renewable Energy Competition

II. Introduction to the Competition

(i) Project description

Energy that is considered to be renewable is energy that is capable of being recycled and can be renewed without the involvement of humans. Solar energy, water potential energy, geothermal energy, ocean energy, biomass energy, and other forms of energy are all included in this category. The term "renewable energy system" refers to the automated system (hardware and software included) that encompasses the latest grid, power, energy management, and dispatching technologies. This is the overall name for the system. Using energy that comes from renewable sources is an efficient way to cut down on carbon emissions.

Today, photovoltaic power production is one of the most widespread methods of producing renewable electricity utilizing "solar energy." It is also one of the most dependable methods. In order to build a solar power generating system, one must consider many different factors, such as surveying and designing the system, adhering to quality standards, constructing and commissioning the system, and operating it safely. The renewable energy competition will be based on a "renewable energy competition platform" that has a complete set of elements and functions, and it will carry out three modules (Module A, Module B, and Module C). These modules include, but are not limited to, PV module parameters and measurements, PV module installation, system matching design and distributed PV access, automatic control and protection, data acquisition and monitoring, automatic operation and visualization, equipment communications, and more. The renewable energy competition platform will also carry out the three modules.

The competition will further promote the improvement of skills, professionalism, teamwork, and the ability to solve and analyze problems in the field of renewable energy; improve the standardization and feasibility of the design and installation of renewable energy systems; explore the ways and means of using other renewable energy sources and feasible solutions through this competition. This competition will be held in the United States. In addition to this, it encourages engagement and interchange across different fields of study, different sectors, and the worldwide community.

（ii）Project competition

1. A platform for competition

The "renewable energy competition platform" will serve as the foundation for the project competition (see "IV. Renewable energy competition platform" for the content of the "renewable energy competition platform").

2. A condensed explanation of the format of the tournament

The competition will be scored completely out of a possible one hundred points depending on the actual implementation of the actual procedure. The whole of the race will take place over the course of ten hours.

(iii) Scope of application of the document

This technical document is only applicable to the technical description of the Renewable Energy Competition of 2022 BRICS Skills Competition. The another part of technical document (English version) will be given at the competition site.

III. Requirements for contestants

It is not planned to conduct any independent exams to evaluate the participants' knowledge and skills since it is presumed that those taking part in this competition already possess the skills and knowledge that are detailed in the following paragraphs.

Participants of the Renewable Energy Competition of 2022 BRICS Skills Competition are required to possess all or part of the following knowle dge and abilities:

- Knowledge related to renewable energy.
- Basic knowledge of electrical engineering.
- Knowledge related to computer technology.
- Knowledge related to automatic control.
- Knowledge related to relay protection of power systems.
- Knowledge related to electrical principles and design.
- Knowledge related to electrical principles and measurement and testing.
- Knowledge related to basic mechanical processing.
- Safety in production and various technical specifications.
- Electrical safety operating procedures.
- Some ability to access English language materials.
- The ability to design and functionally improve electrical control circuits.
- The ability to detect and locate faults in electrical control devices.
- Ability to use programmable logic controllers.
- The ability to design and functionally debug industrial configuration software.
- The ability to rationalize the selection and correct use of tools.
- Ability to express and communicate.

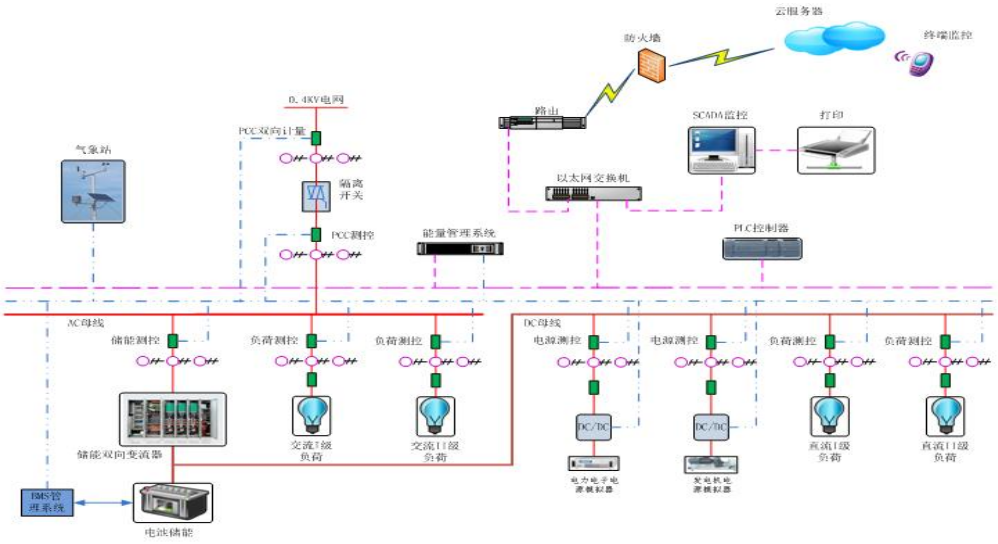
IV. Renewable energy competition platform

(i) Renewable energy competition platform

Figure 1 and Figure 2 below show the physical diagram and electrical structure of the renewable energy competition platform respectively.

（a） （b） （c） （d） （e） （f）

Figure I. Physical reference diagram of the renewable energy competition



platform

Figure 2. Electrical structure of the renewable energy competition platform

1. Platform composition and role description

(a) Renewable energy photovoltaic power supply unit

The main body of the renewable energy photovoltaic power supply device includes photovoltaic modules, module supports, and installation foundations. Each component of the device has been painstakingly designed to simulate the distributed power supply component of a small photovoltaic power plant, including its dimensions, materials, and operational capabilities. Participants in the competition make use of the material and gadgets that are

supplied to them in order to finish the installation while following the instructions on the design drawings. The building procedure and the standard installation requirements that were followed throughout this process of installation are completely suitable to the actual environment.

（b） Renewable energy equipment access and energy management system (1# cabinet)

A programmable logic controller (PLC), an energy dispatch controller (EMS), an industrial Ethernet switch, a single-phase metering instrument, a microcomputer protection device, a current transformer, human-machine interface, a test terminal, and other components are included in the device. Through the utilization of an energy scheduling controller, it not only completes the control, metering, and protection of the energy interaction that occurs between the system and the power grid, but it also manages and schedules the microgrid's energy storage, distributed power supply, AC and DC loads, and other components in order to realize a smooth, stable, economically viable, and efficient operation of the microgrid.

(c) Renewable energy equipment energy storage and stability control system (2# cabinet)

The components of the system include a current transformer, a shunt, test terminals, a low-voltage line protector, a DC power metering instrument, a converter, a switching switch, an energy storage battery bank, a BMS battery monitoring system, and an energy storage battery bank. Its primary function is to control the charging and discharging of energy storage, and it also includes a bidirectional converter of DC bus and AC bus, as well as built-in isolation for the microgrid and parallel network switching with the utility grid.

(d) Renewable energy equipment distributed energy access system (3#

cabinet)

The PV controller, DC power metering instrument, shunt, test terminal, and other components are the primary elements that make up the system. The primary function of the device is to finish off the access to distributed energy as well as the monitoring and protection of distributed power production.

(e) AC/DC load management system for renewable energy equipment (4# cabinet)

The components that make up the system include an AC-DC load management system, an AC-DC simulated load, a DC power metering meter, an AC power metering meter, a shunt, an AC contactor, and other test terminals. It is able to model load throwing and cutting control in the system, simulate automated scheduling control for various levels of loads, and examine the parameters of operation in relation to load via software simulation.

(f) SCADA power monitoring system for renewable energy equipment

The control system, the operation console, the communication connection, the SCADA power monitoring software, and a number of other components make up the monitoring platform. It brings the monitoring and control of the functioning of the microgrid system to a close.

It features online real-time monitoring of system data and status data; dynamic display of real-time curve and historical curve; online setting and modification of system parameters; connection to energy management system via Ethernet with fast telematics, telemetry, and remote control and management functions; and analog microgrid automation power dispatch control and management functions. Historical data can be stored and queried from the database.

2. Description of the expected results of the competition.

(1) The photovoltaic modules of the renewable energy system have been

developed and finished in accordance with the requirements. These modules have also been fitted in accordance with the drawings, and the procedure adheres to the design standard standards. The method of construction makes it possible to provide adequate safety protection for both workers and their equipment.

(2) The renewable energy system can successfully be linked to the grid and can be dispatched to optimize the coordination of each load and energy storage device in order to achieve power peaking. This is possible thanks to the system's ability to accomplish power peaking.

(3) A move away from the grid in the association may be completed very fast.

(4) Off-grid coordination of distributed power production, energy storage devices, and loads for the purpose of ensuring power supply to essential loads of renewable energy systems and maintaining the safe functioning of renewable energy systems.

(5) Each node may be operated locally or remotely, and the data stored on each node can be read, monitored, and used to generate data reports that can be queried by the user.

V. Competition Evaluation Criteria

(i) The distribution of points and judging process

Rating Score

Module	Standards	Score		
		Subjective	Objective	Total Score
A	Design and planning of PV modules	0	15	15
	Installation of PV modules	0	15	15
B	System matching design and distributed PV access	0	15	15
	Automatic control and protection	0	20	20

C	Data acquisition and monitoring	0	20	20
	Automatic operation and visualization	0	20	20
Total score		0	100	100

Judging Process

Serial number	Judging Process	Scoring Method	Remarks
1	Judges are trained, grouped and divided according to the scoring sheet	One score sheet per player, rotated among each panel of judges	The scoring table marks the competition station number
2	Head judge chooses 1 team leader for each judging team	The scoring is based on the scoring criteria only, without any discussion	To ensure consistency in the judging of an individual event
3	Streaming work to score the players	A panel of judges will score a single event for a competitor	
4	Organizing committee and technical support team will provide score entry personnel, judges' representatives will log scores under the leadership of the head judge and other judges will supervise	At the end of each day's competition, the results will be evaluated, and the results of each individual item on each score sheet will be summarized and reviewed	Referees should sign the score sheet
5	Disputes arise	Arbitration is organized by the head judge according to the technical documents of the competition	The organizing committee of the competition verifies the assessment results and announces them
6	The total score of players	Summation of all scored items	Appeals are valid on the same day

(i) Evaluation principles

1. Open, fair and impartial organizational principles

When planning any facet of the competition, it is essential to observe the organizational values of transparency, fairness, and impartiality at all times. The availability of technical documentation, example questions for competitions, acceptable design of competition rules, processes, and standards, transparent implementation process, stringent proposal, recusal of judges, and other institutional measures are all ways to guarantee that competitions are fair.

2. Principles of examination points

The content of the competition is designed to correspond to relevant occupational positions or job groups, to reflect professional core competence and core knowledge, and to cover a rich variety of professional knowledge and skill points. The purpose of this competition is to test participants' abilities in the core competencies of renewable energy, innovation, and design. The fundamental knowledge includes information pertaining to renewable energy; the investigation surface has been finished; the investigation point has been verified; and the investigation quantity has been determined with precision.

Use mature competition platforms

The competition platform has to be mature; in accordance with the worldwide social industry hotspots, the competition chooses equipment and software that is reasonably modern, ubiquitous, and has a high social retention rate.