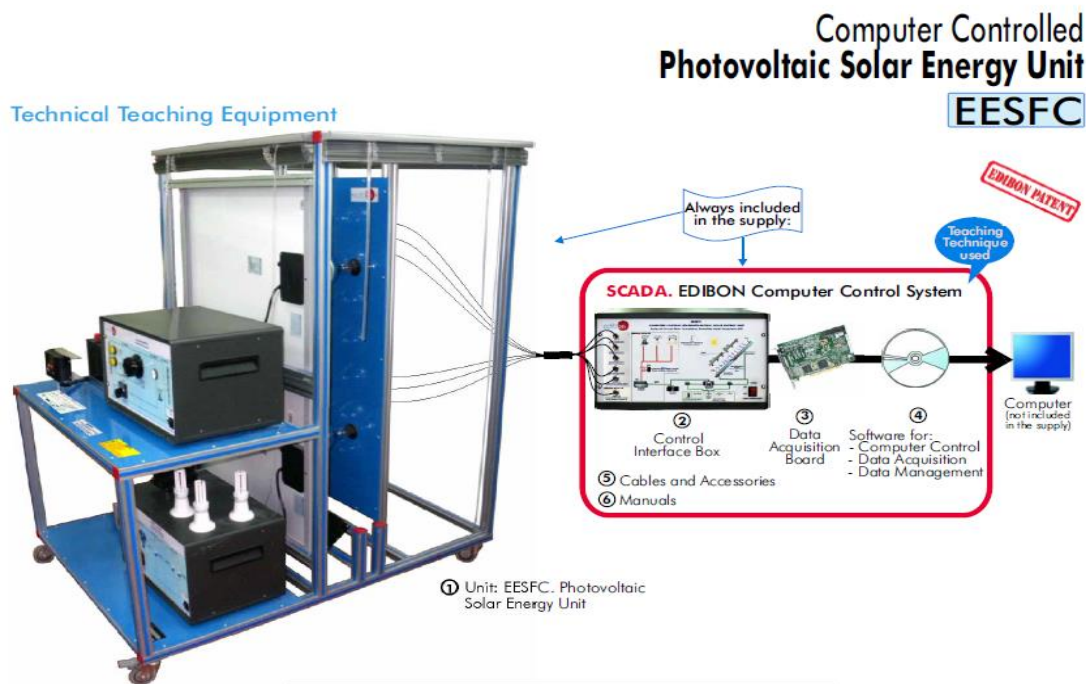# 1. Computer Controlled photovoltaic Solar Energy Unit (EESFC)

"EESFC" is a unit, computer controlled, for the study of the transformation of solar energy in electric energy.

This unit uses the photo conversion solar system for the direct conversion of solar radiation into electricity. The absorbed energy is provided by simulated solar radiation; in our case, this is done by means of a panel with powerful light sources.
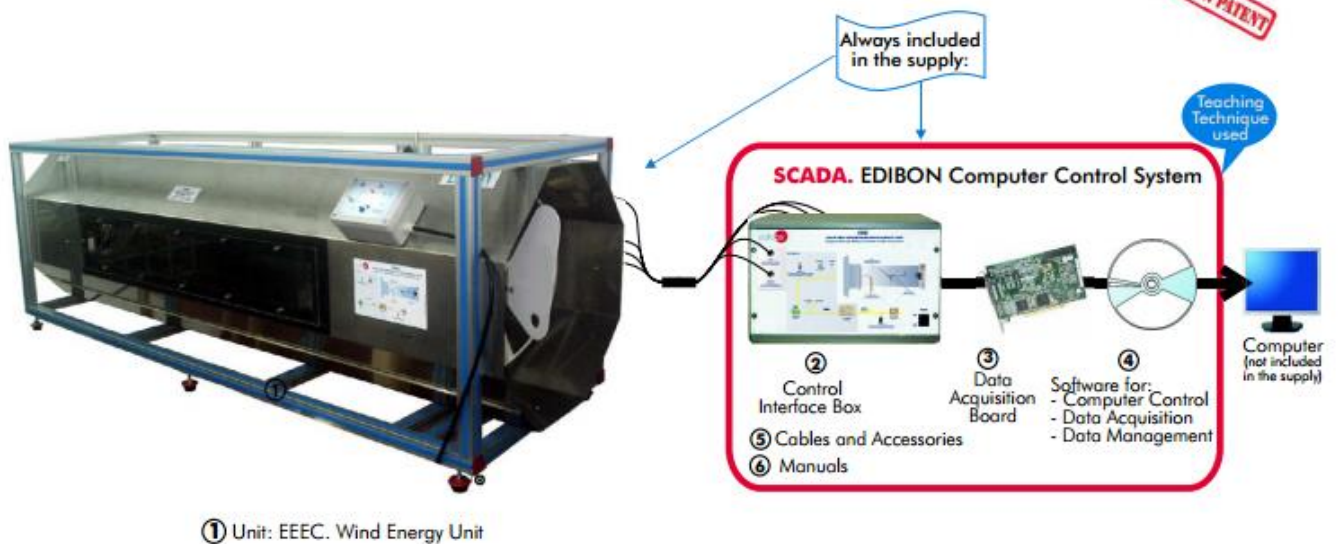
Basically it is formed by:

-Photovoltaic Solar Panels.

-Solar Simulator formed by solar lamps.

-DC Load and Battery Charger Regulator.

-Auxiliary battery charger.

-2 Batteries.

-DC Loads Module.

-Sensors (temperature, light radiation, DC current and DC voltage).

-EDIBON Computer Control System (SCADA), including: Control Interface Box, Data Acquisition Board, Computer Control and Data Acquisition Software, for controlling the process and the involved parameters.

2. Computer Controlled Wind Energy Unit (EEEC)

Computer Controlled **Wind Energy Unit**
EEEC

Technical Teaching Equipment

Always included in the supply:

SCADA. EDIBON Computer Control System

Teaching Technique used

② Control Interface Box

③ Data Acquisition Board

④ Software for:
- Computer Control
- Data Acquisition
- Data Management

⑤ Cables and Accessories

⑥ Manuals

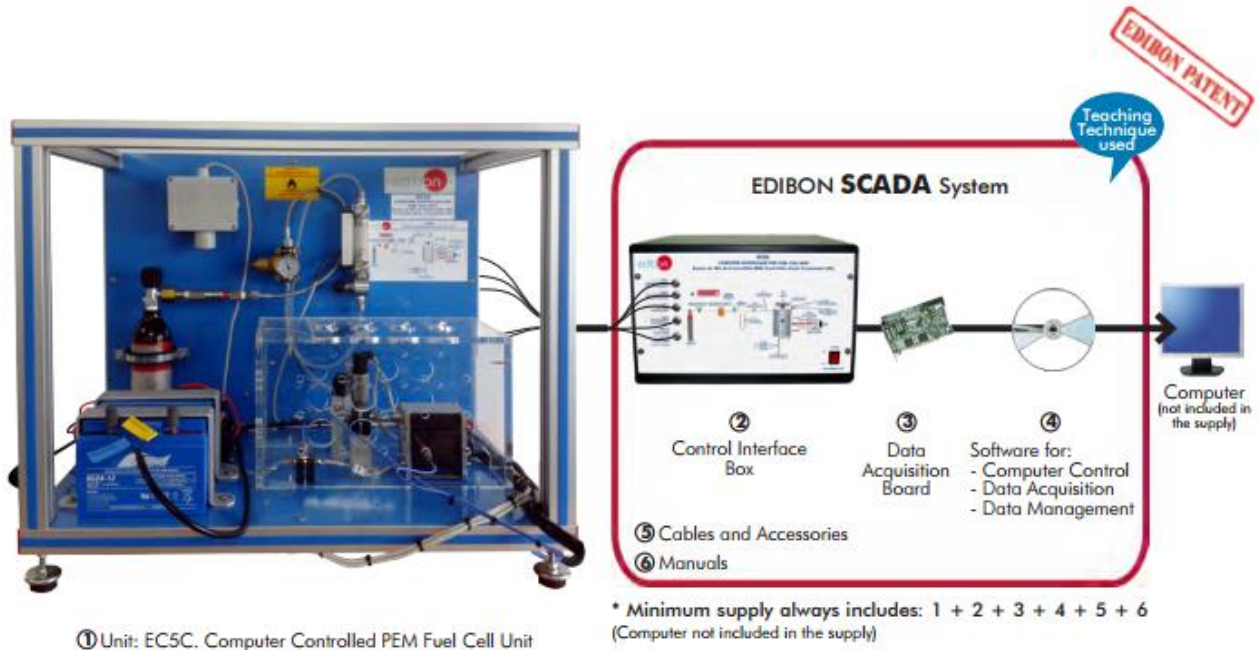Computer (not included in the supply)

① Unit: EEEC. Wind Energy Unit

"EEEC"is a laboratory-scale unit designed to study the air energy and the influence of some factors on this generation. The axial flux fan introduces air in the tunnel. The air speed sensor let us to measure air speed. It is possible to know, in real time, the value of voltage and current given by aero generator, measured before and after the regulator. We can measure the speed of the air, with a sensor placed in the tunnel, and also know the rotational speed of the aero generator (r.p.m.). There is one temperature probe before the rotor, in order to know the temperature for density calculation. This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), including: Control Interface Box, Data Acquisition Board, Computer Control and Data Acquisition Software, for controlling the process and the parameters involved.

3. Computer Controlled PEM Fuel Cell Unit (EC5C)

Computer Controlled PEM Fuel Cell Unit, with SCADA

EC5C

Technical Teaching Equipment

EDIBON SCADA System

② Control Interface Box

③ Data Acquisition Board

④ Software for:
- Computer Control
- Data Acquisition
- Data Management

⑤ Cables and Accessories

⑥ Manuals

Computer (not included in the supply)

* Minimum supply always includes: 1 + 2 + 3 + 4 + 5 + 6
(Computer not included in the supply)

① Unit: EC5C. Computer Controlled PEM Fuel Cell Unit

The Computer Controlled PEM Fuel Cell Unit "EC5C" is designed to allow the students to understand the fuel cells technology; especially that of a proton exchange membrane fuel cell (PEM). The "EC5C" unit is supplied with a stack of proton exchange membrane fuel cell (PEM) with a rated power of 100W. The stack is composed of 24 cells with the shape of channeled plates that allow the air flow through the membrane. The membrane facilitates the hydrogen flow, generating the electrons release. There are separating plates which conduct electricity, allowing thus such electrons flow, between each pair of cells. Cells are self-humidifying and do not require any type of external humidification. The stack has an integrated fan able to provide the required air for good operation and to maintain the appropriate temperature. Hydrogen storage represents one of the essential points regarding the hydrogen economy. For that purpose, a cylinder of metal hydride (300NL) is included. Thanks to the absorption of the hydrogen inside, hydrogen is stored in a safe and certified way. Since the discharge pressure of the metal hydride cylinder is 15-20 bar, the "EC5C" unit also includes two pressure regulators; one of them is prepared to be installed in the H_2 cylinder in order to regulate the outlet pressure at 5-50 bar; the other is placed at the outlet of the metal hydride cylinder in order to regulate the inlet pressure to the stack in a range from 0.50 to 0.55 bar. The unit also includes two solenoid valves. One of them is located before the stack and controls the hydrogen inlet and when the unit is

switched off, the valve is closed to avoid any possible hydrogen leakage. The other valve, placed at the stack outlet, purges the excess of water and hydrogen towards the exterior for a proper operation. The unit has a load regulation system. It enables the study of the generated electrical energy, the representation of the characteristic operation curves and their comparison with the theoretical curves. It includes a variable power rheostat, which enables to vary the generated power. The unit includes a battery that supplies 12V to the Interface. The whole electrical circuit of the stack is protected by a short circuit unit in case of an over current (12A) and low voltage shut down (12V). It includes a hydrogen leak detector with a detection range from 0 to 2% Vol. and from 0 to 100% L.E.L. respectively. This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), and includes: The unit itself, a Control Interface Box, a Data Acquisition Board, Computer Control, Data Acquisition and Data Management Software Packages, for controlling the process and all parameters involved in the process.

4. Grid Connection Inverter Kit

Inverter used for the conversion and injection to the grid of the power generated by a simulated source of renewable energy. The simulated source is a simulator used to obtain a variable power to be injected to the grid. The operation mode is displayed by means of a LED indicator at the front side of the housing. It is equipped with extensive safety measures to ensure that it switches off immediately as soon as the AC plug is removed from the wall socket or the public grid fails in operation. The inverter can be connected to a PC through RS232 communication to display some parameters such as voltage and current inputs, mains voltage and frequency, maximum AC power, Kwh, etc.