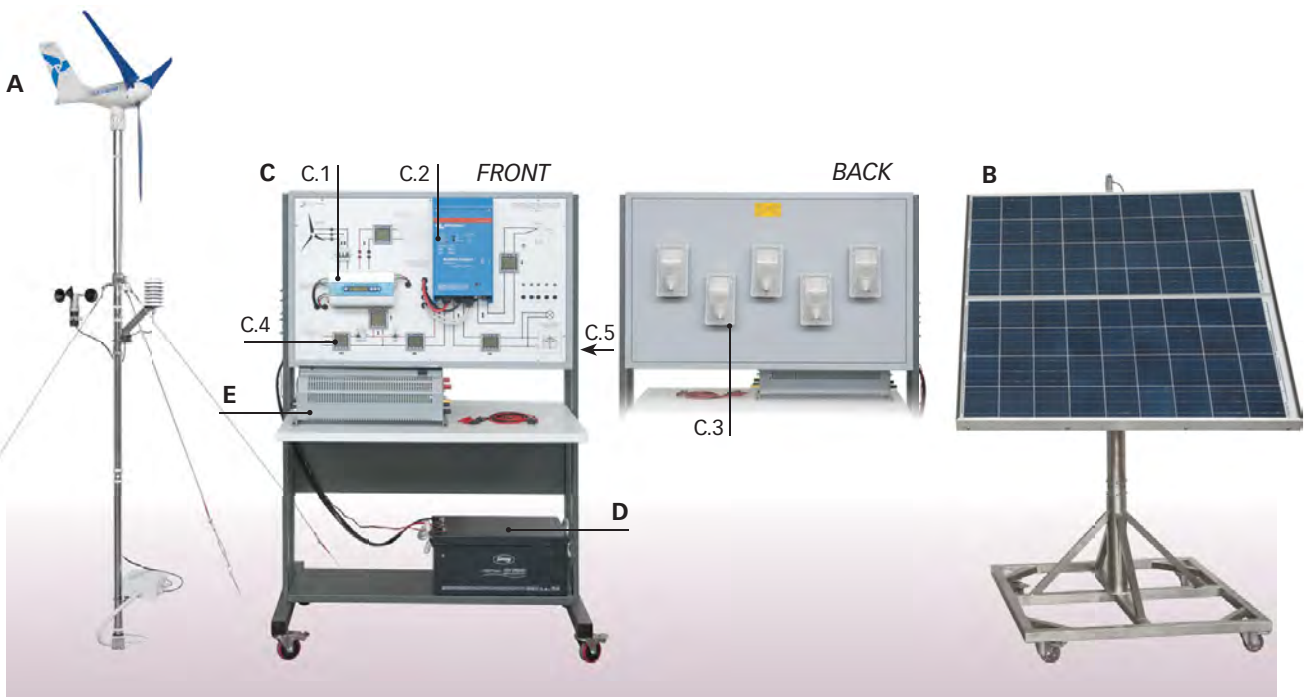


GRID-CONNECTED RENEWABLE ENERGY SYSTEM

Mod. REMDI/EV



INTRODUCTION

Nowadays the use of domestic electrical energy is changing and this trend is evolving with time.

This change is related to the interconnection of renewable energies (photovoltaic and wind energy, the most common in domestic use) with the public grid, in a totally transparent way for the end user.

This change carries the following consequences:

- Reduction of fossil fuels consumption at the electrical power houses and the related pollution
- For countries with no fossil fuel resources, a reduction in the national energy bill and the subsequent increased independence from oil and gas producers
- For remote areas, increased energy independence and selfsufficiency
- Reduction of Joule losses in electrical power transmission lines
- And finally a consistent saving in the electrical costs for the end user

Elettronica Veneta Spa, always in line with technical advancements and trends, has designed this system for the future generations of engineers that will face this change.

DESCRIPTION

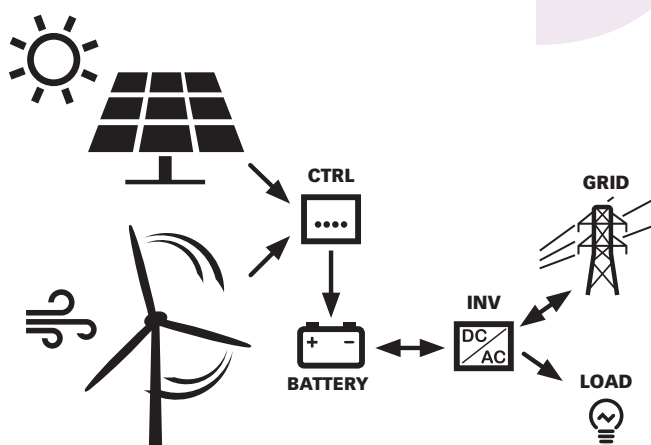
This advanced system combines the study of the most common domestic renewable energies with their interconnection devices and circuits to the public grid.

The system consists of:

- A)** A wind turbine generator
- B)** A silicon cell photovoltaic panel
- C)** A wheeled panel including:
 - C.1)** A hybrid charge controller
 - C.2)** A sinewave inverter / battery charger
 - C.3)** Electrical loads
 - C.4)** Electric instrumentation for detecting the energy flows in the different branches of the circuit
 - C.5)** USB interface for PC connection
- D)** Buffer battery
- E)** Portable rheostat

Relevant features:

- Each renewable energy source can be studied independently, combined or integrated with the grid
- The photovoltaic panel and the wind generator can be used both outdoors and indoors. In case of indoor use, optional indoor operation devices are required (refer respectively to models SS-1/EV and WG-1/EV at the end of this data sheet).
- The photovoltaic panel can be disconnected from the system, for constructing the characteristic curve (one single module, two modules connected in parallel, two modules connected in series).
- The photovoltaic panel can track the sun along two axes, to allow the comparison of the performance between a fixed installation (such as the one on the roof of a house) and an installation with tracking device.
- Experimental data can be saved for future analysis and project work.

Operating principle:

All the energy consumed by the user (loads) is taken from the battery. Therefore all the system is intended to charge the battery.

When consumption is higher than the available energy (from the battery and the renewable energy sources), the additionally required energy is supplied by the grid. On the contrary, when consumption is lower than the available energy, the excess power is fed to the grid.

The system includes the measuring devices for detecting the energy flows to and from the grid.

TRAINING PROGRAM:

- Physical principles whereby wind power is transformed into electrical power
- Study of brushless generators
- Physical principles whereby solar power is transformed into electrical power
- Characteristics and application of silicon cells
- Wind Turbine Generator:
 - Understanding and use of the Country Statistics related to the specific place where the wind generator is installed
 - Calculation of average generated power
 - Distinctive features
 - Installation
 - Energy balance and efficiency

Photovoltaic Generation:

- Understanding and use of the Country Statistics related to the specific place where the photovoltaic panels are installed
- Calculation of the average solar power a given site
- Distinctive features
- Optimizing installation and positioning
- Energy balance and efficiency
- Battery charge control
- Study of the Interconnection of Renewable Energies and the Public Grid:
 - Study of the hybrid charge controller: circuits and functions
 - Study of the sinewave inverter / battery charger: circuits and functions
- Study of energy flows and related measurement devices

TECHNICAL SPECIFICATIONS:**Wind power generator:**

- Three carbon fibre blades, rotor diameter: 1,15 m
 - Rated wind speed: 14,5 m/s (52 km/h)
 - Start-up wind speed: 2,2 m/s (8 km/h)
 - Start-up charging: 2,5 m/s (9 km/h)
- Three phase permanent magnet generator:
 - Rated voltage: 12 VDC
 - Rated power output: 420 W
 - Charging indicator: LED-blue
- Stackable mast:
 - Material: polished stainless steel
 - Length of the tubes: 3 x 1 m
 - Total height: 2,8 m
 - External diameter: 48,1 mm
 - Mounting Kit

Mobile photovoltaic solar array:

- Wheeled stainless steel frame
- Photovoltaic panel including two modules, 115 W peak power each
- Solar tracker:
 - automatic/manual two axes tracking: RIGHT/LEFT and UP/DOWN for maximum insolation
 - solar sensors assembly
 - actuators with DC motors

Mobile control panel:

- Wheeled steel structure with:
 - front side: comprehensive colored diagram of the system
 - back side: AC loading system consisting of 5 30 W switchable lamps
 - shelf for the buffer battery (12 VDC, 260 Ah)
- Hybrid charge controller:
 - Max. power input from wind generator: 600 W
 - Max. current input from wind generator: 40 A
 - Max. power input from solar panel: 550 Wp
 - Max. current input of the solar panel: 40 A
 - Max. total charge current: 80 A
 - Max. switch off current at LOAD-output: 15 A
 - LCD-display for visualizing all operating parameters
 - 5 touch keys
 - 2 signaling LEDs
 - Thermally switched vent for the correct operating temperature
 - All types of lead batteries (Gel, AGM and acid) can be charged

- Sinewave inverter / battery charger featuring adaptive charge technology and high speed power transfer switch:
 - Inverter:
 - Input voltage range: 9,5-17 VDC
 - Output: voltage 230 VAC \pm 2%, frequency 50 Hz \pm 0,1%
 - Continuous output power at 25°C: 800 VA
 - Continuous output power at 25°C: 700 W
 - Peak power: 1600 W
 - Charger:
 - Input 187-265 VAC, 45-55Hz, Power Factor: 1
 - Charge current battery: 35 A

Instrumentation, including:

- 4 instruments, microprocessor-based, for DC parameters
- 2 instruments, microprocessor-based, for AC parameters

Sensors

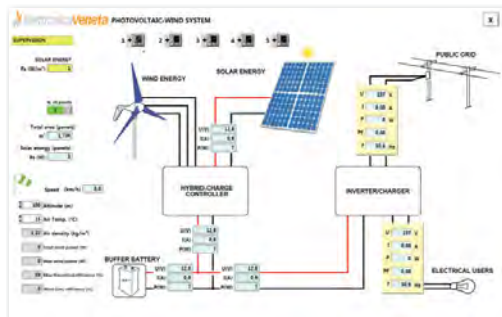
- 1 anemometer probe for measuring and transmitting wind speed to control panel
- 1 temperature sensor for measuring and transmitting the environment air temperature to control panel
- 1 pyranometer probe for measuring and transmitting photovoltaic panel incident solar radiation to control panel
- 1 temperature sensor for measuring and transmitting photovoltaic panel temperature to control panel

Portable Rheostat useful for tracing the photovoltaic panel characteristic curve:

- Control slider
- Double winding each with 4 sections
- Ohmic value: 2 x 20 ohm
- Power: 1200 W

PC data acquisition

- All instruments and sensors, as described above, are connected in Modbus network. This network is connected to a PC via an adapter RS485/USB.
- A specific software (developed with LabView) is supplied to monitor the different parameters of the system.
- Parameters displayed:
 - all DC (V-I-P) and AC (V-I-P-S-Freq-Power Factor) parameters
 - wind speed
 - environment air temperature
 - photovoltaic panel incident solar radiation
 - photovoltaic panel temperature



- The software enables to:
 - Calculate wind and solar energy conversion efficiency
 - Visualize the energy flows to and from the public grid



- Save the exercises data for future analysis or project work

Power supply: 230 Vac 50 Hz single-phase
(Other voltage and frequency on request)

Dimensions

Control panel: 112 x 60 x 160 cm
 Wind turbine rotor diameter: 115 cm
 Solar array: 120 x 120 x 200 cm
Total net weight: 330 kg

REQUIRED

PERSONAL COMPUTER
- NOT INCLUDED -



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

WIND POWER GENERATOR INDOOR OPERATION DEVICE Mod. WG-1/EV
To operate the aerogenerator indoor



INDOOR LIGHTING DEVICE
Mod. SS-1/EV

To operate the photovoltaic panel indoor

TRAINER VARIATIONS UPON REQUEST

The Trainer is also available in special versions without wind power generator or without photovoltaic panel.