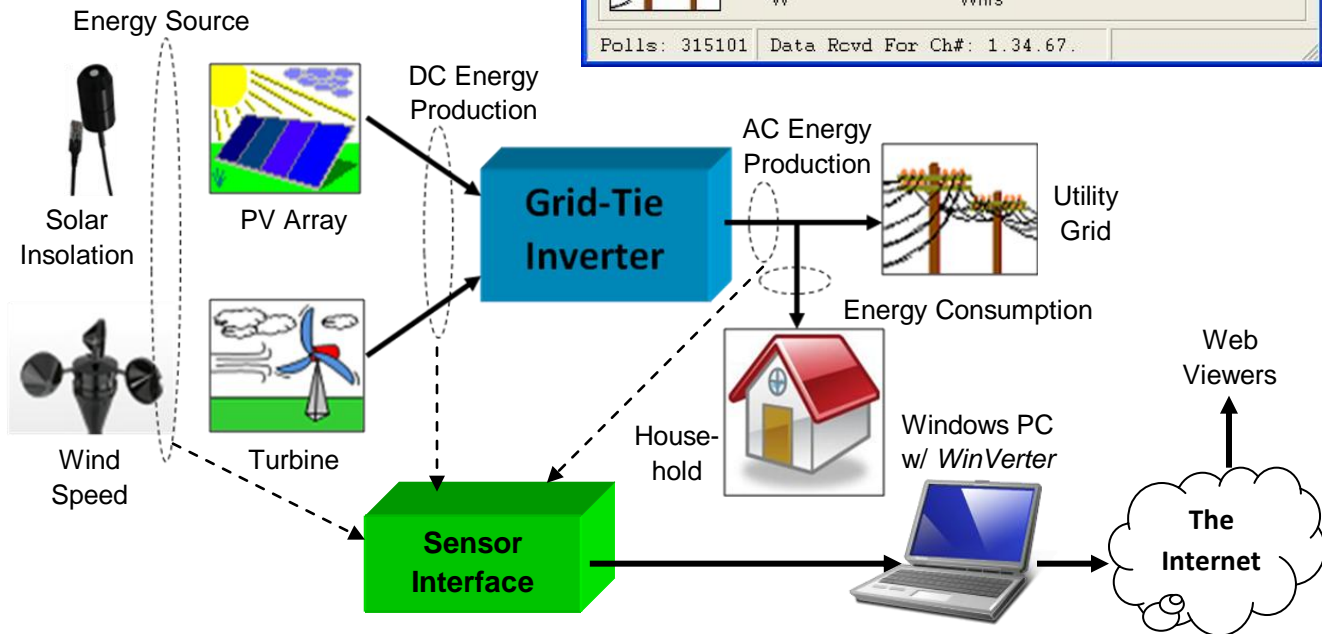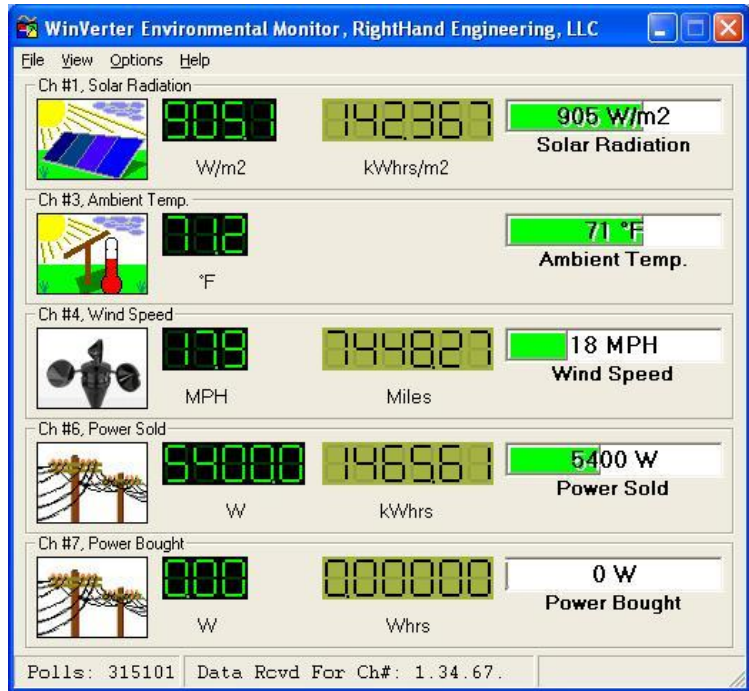# *WinVerter Environmental Monitor*

WinVerter™ Environmental Monitor (WV-EM) is a monitoring system designed to work with a wide variety of electrical renewable energy systems and applications. It is capable of monitoring energy source (wind speed and/or solar insolation), energy production and energy consumption. Because it uses external sensors, *WV-EM* works with any brand or model of charge controller or inverter, providing a single, unified and universal monitoring system. It is an ideal solution for systems that use a mixture of charge sources or equipment from multiple manufacturers which would otherwise require multiple monitoring systems.

WV-EM uses a combination of an on-site external sensor interface, a variety of sensors, and a Windows PC as a local or remote "server" to provide real-time data display, data logging, graphing, email, and web page creation. Because it uses the owner's PC, *WV-EM* avoids the recurring fees and potential loss of web-transported data associated with web-hosted solution.

Options exist for monitoring energy sources (wind speed, solar insolation), energy production & consumption (kilowatt-hours), and various other AC or DC electrical parameters (voltage, amperage, wattage). Unlike some systems that rely on inverter-internal sensors, *WV-EM*'s energy production measurements have nearly the accuracy of utility revenue-grade meters.

RightHand Engineering, LLC   www.RightHandEng.com   info@RightHandEng.com   425-844-1291

Features

WV-EM is available in three versions; Standard, Professional and special Kiosk version which provides public or community renewable energy projects with on-site touch-screen and remote web displays. The following table compares the features available for each version.
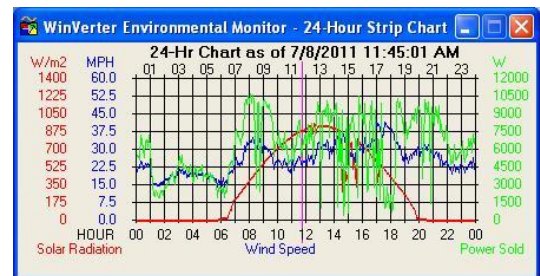
Feature	Standard	Professional	Kiosk
Wind speed and direction sensors	Option	Option	Option
Solar insolation sensor	Option	Option	Option
Temperature sensors	Option	Option	Option
AC current, voltage, power & energy sensors	Option	Option	Option
DC current, voltage, power & energy sensors	Option	Option	Option
Generic analog and pulse sensor inputs	Yes	Yes	Yes
Generic binary outputs (e.g. generator start)	Option	Option	Option
RS-232 interface to hardware for local connection	Yes	Yes	Yes
Ethernet interface to hardware for local or remote connection	Option	Option	Option
PC hosted – no recurring host fees	Yes	Yes	Yes
Runs under Windows XP or Windows 7	Yes	Yes	Yes
Real-time local PC display	Yes	Yes	Yes
24-hour strip chart graph	Yes	Yes	Yes
Energy comparison between present and past calendar periods	Yes	Yes	Yes
System efficiency display	Yes	Yes	Yes
Hourly data log samples (CSV format)	Yes	Yes	Yes
Graphing of hourly data logs	Option	Yes	Yes
Sub-minute data log samples (CSV format)		Yes	Yes
Email of system health messages, including drop in efficiency		Yes	Yes
On-the-fly Web page creation for internet display[1]		Yes	Yes
Automatic FTP transfer of web pages & log files[1]		Yes	Yes
Support for touch-screen public display[1]			Yes
Support for LED reader-board public display			Option
Annual maintenance agreement (free support & updates)			Option
Factory customization for special applications		Option	Option

Note 1: Web-posting, Kiosk features and unattended operation require dedicated use of the PC

PC Displays

WV-EM can display a variety of types of information on the host PC's screen.
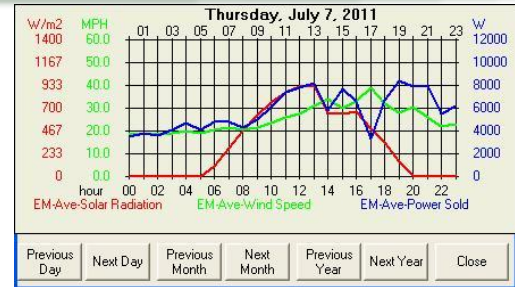
- The meter display (see front sheet) shows real time information both numerically in a bar-graph form.

- The strip-chart display (right) graphs the last 24-hours for three selectable parameters.

- The comparison display (bottom right) shows a numeric comparison of past and present energy accumulations for this and last day, week, month and year.

- The efficiency display shows the power conversion efficiency of two selectable parameters.

- If output control is enabled, on-screen buttons allow controlling several binary outputs for applications such as starting generators.

Data Logging

While *WV-EM* is running, it is also logging data to comma separated value (CSV) files in the background. Such files are easily imported into spread-sheets for analysis. A utility also allows easy graphing of past data for a specific day, month or year.

Remote Notification & Access

The Professional version of *WV-EM* supports remote email notification and web-page access.

The system can be configured to send emails based on configurable thresholds, and can also send daily "I'm OK" messages containing present system status as confirmation that the system is still operational. Thresholds can include detection of a drop in system efficiency which can occur if PV panels become soiled or stolen, or if the system has experienced a failure.

The system can also be configured to automatically generate web pages (see right) and FTP those pages to a designated web host on a frequent basis. The web page can show the present readings of up to 4 values, plus daily and life-time accumulation of energy production, and graphs showing the last 24-hours, yesterday, this month and this year.

Kiosk Version

The special Kiosk version includes all of the features of the Professional version, but also adds support for touch screen operation (the touch screen monitor may be supplied by the customer). The Kiosk version is designed for easy, intuitive touch operation by the general public and prevents the public from accessing anything on the PC other than *WV-EM*'s screen. The Kiosk version is ideal for community renewable energy projects which have on-site public displays. For sites that need large displays for distant viewing (such as drive-by traffic, or large rooms), the Kiosk version can also support an optional LED reader board showing scrolling data.

WV-EM vs. Inverter-Integrated and Web-Hosted Monitoring

As renewable energy becomes more mainstream, more and more inverter manufacturers are offering their own monitoring solutions. Most of these monitoring solutions are web-based, meaning that the system data is transported to the manufacturer's server where the manufacturer posts web pages on behalf of the user. While this may be convenient and have a relatively low up-front cost, there are some inherent disadvantages to inverter-integrated and web-hosted solutions.

PROBLEM	SOLUTION
PROPRIETARY SOLUTIONS: Most solutions are specific to one manufacturer's power conversion equipment. If a system includes equipment from multiple power conversion manufacturers there may be multiple monitoring systems required.	*WV-EM* is a universal solution that works with all types of charge sources, and any manufacturer's power conversion equipment.
INACCURATE DATA: Most solutions make use of the power conversion equipment's internal meters. The problem is that most internal meters have poor accuracy, often no better than 120 watt resolution.	*WV-EM*'s external AC sensors have an accuracy nearly as good as utility revenue grade meters.
LACK OF ENERGY SOURCE INFO: Most solutions provide power and energy information, but do not provide energy source information (wind speed, solar insolation). Without knowing the energy source it isn't possible to know if the system is working properly.	*WV-EM* is able to monitor both energy source and energy production, which allows it to monitor system efficiency, and notify the customer or their dealer of problems that may indicate equipment theft or need for service.
LACK OF ENERGY CONSUMPTION INFO: Most solutions provide energy production information, but do not provide energy consumption information.	*WV-EM* can be equipped to monitor both production and consumption. Seeing actual consumption in real-time allows customers to be more effective in conservation efforts.
LACK OF CONTROL: Many solutions allow only monitoring, but have no provisions for control.	*WV-EM* can be configured to control binary outputs which can start/stop a generator among other uses.
LACK OF ON-SITE DISPLAY: Many solutions post the data to the web, but have no or poor on-site display. The lack of on-site display makes it hard to troubleshoot systems, and makes it hard to show visitors the immediate effects of wind speed and solar radiation changes.	*WV-EM* provides on-site, real-time display so that users can see the immediate effects of changes in source and/or consumption and allows service personnel to more effectively troubleshoot the system.
LACK OF REAL-TIME DISPLAY: Most solutions only provide infrequent data updates – often several minutes between updates, and sometimes up to an hour.	*WV-EM* provides local display updates every few seconds, and web updates as frequently as every minute.
LACK OF LOCAL DATA STORAGE: Most solutions have no data storage on-site but rather depend on the manufacturer's web server to gather and store the data. At times when the web connection between the owner and manufacturer is down, the data is permanently lost	*WV-EM* is customer owned and hosted. The customer can configure their PC for the level of data integrity that they desire.
RECURRING FEES: Some manufacturers begin charging a recurring annual fee after the first year or few years to recover their hosting costs. Other manufacturers charge an extra fee for customers who want to access their data logs over the web.	*WV-EM* is customer owned and hosted and thus avoids present and future recurring fees, and makes total cost of ownership predictable.

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SYSTEM SPECIFICATIONS

Sensor Specifications

Wind Speed Sensor (anemometer):	+/- 0.1 m/s (0.2 MPH) between 5 to 25 m/s (11 to 55 MPH)
Solar Insolation Sensor :	50 to 1800 W/m^2, +/- 5% full scale accuracy
Temperature Sensor:	-40°C to 60°C (-40°F to 140°F), +/- 1°C accuracy
AC Power/Energy Sensor:	96-288 V single phase (3 phase available), 48-62 Hz, available from 5 to 400 Ampere full scale, bi-directional (direction of power can be sensed). +/- 1% accuracy for > 10% of full scale
DC Current/Voltage Sensor:	0 to 20, 50, 100 or 500 Amps, 0 to 60 Volts. High-side shunt. 0.1% full scale resolution

Other sensors are available. Contact us with your needs.

Sensor Interface Specifications

Analog Measurement Range:	0 to 5 volts
Analog Measurement Resolution:	12-bit A-to-D (4096 steps) or < 0.03% of full scale
Interface Power Requirements:	9 to 76 volts DC, < 0.5 watts (universal AC adapter available)

PC Requirements

- Intel Pentium (or equivalent) or better processor
- Processor Speed:
  633 MHz or better for Standard version.
  1.2 GHz or better for Professional & Kiosk version.
- Microsoft Windows® XP SP2 or 7 operating system (Vista not supported)
- 512 MB RAM or as required by the operating system, whichever is higher
- 50 MB of free hard disk space plus 1 MB per month for standard daily logs, or 10 MB per month for professional data logs.
- Multi-read CDROM drive recommended
- Video Display:
  1024 x 768 pixel minimum
  (1280 x 1024 or larger recommended)
- Pointing device, such as mouse, track-ball (and touch screen for Kiosk version)
- Communications:
  One 9 pin RS-232 serial port for serial version, One RJ45 Ethernet port for Ethernet version.
  Full-time 50 kbps or higher internet connection required for email, web and FTP services (Professional version)
- For continuous, unattended operation, web posting or Kiosk version the following is required:
  - No additional non-core software may be run while *WinVerter* is running.
  - All automatic pop-up windows must be disabled.
  - Meet the minimum hardware requirement for all software running on the PC.
  - Latest drivers compatible with the OS for the installed hardware.
  - The particular model of PC should be listed on the Microsoft Hardware Compatibility List (HCL) for the installed OS.

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