

# Powerguard Renewable Energy Control System

## PV Solar • Wind Turbine

### Overview

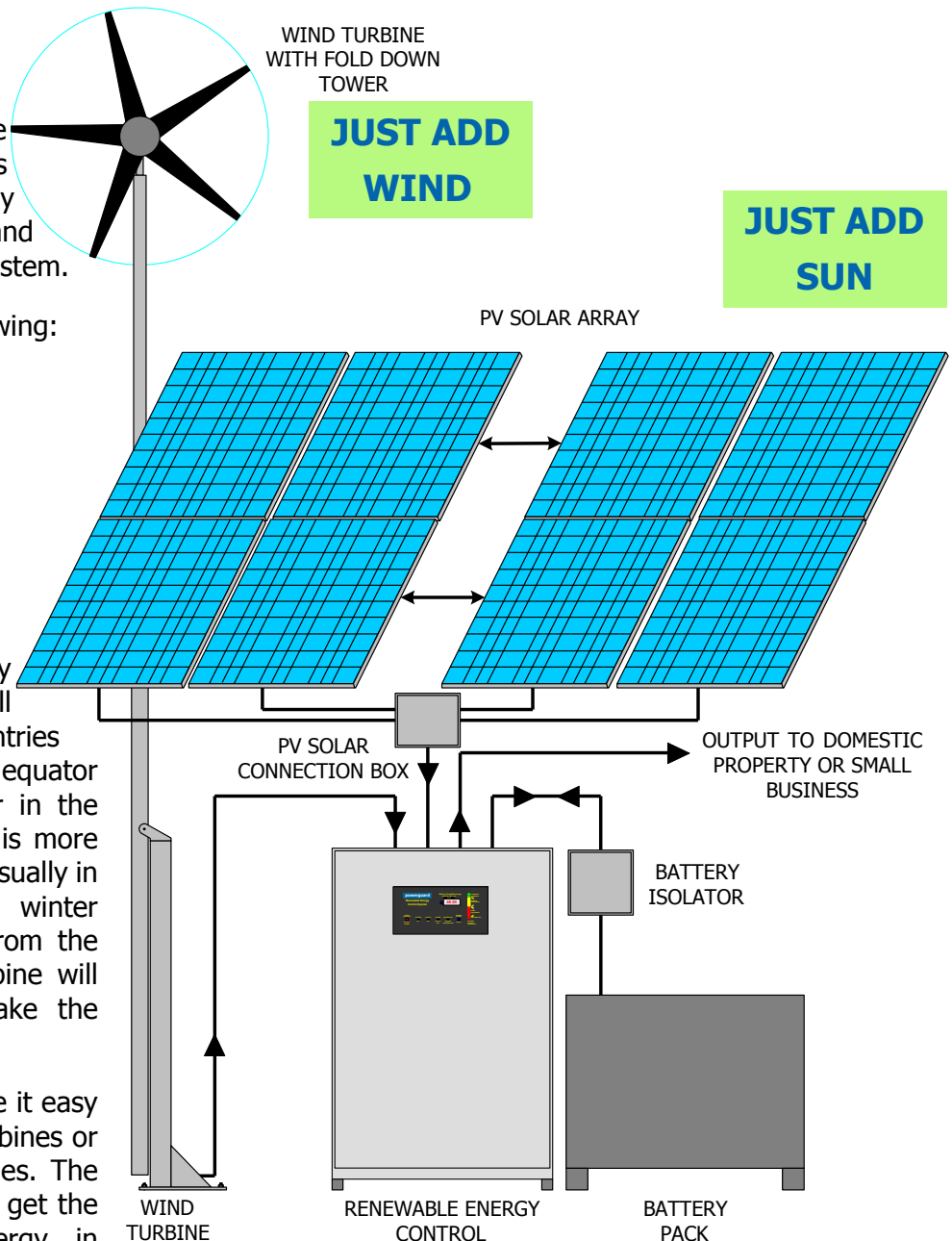
The Powerguard Renewable Energy Control (REC) system is designed to allow the easy implementation of an efficient and integrated renewable energy system.

The system comprises the following:

- Renewable Energy Control
- Battery pack
- Battery isolator
- PV solar array
- PV solar connection box
- Wind turbine if required

In many applications in many countries PV solar will provide all the energy required. In countries further north or south of the equator the energy from the PV solar in the winter months is lower and it is more difficult to get enough power. Usually in these countries during the winter months the power available from the wind is higher so a wind turbine will normally compensate and make the system more practical.

The system is designed to make it easy to connect PV solar or wind turbines or both PV solar and wind turbines. The system can be implemented to get the best out of renewable energy in virtually every country in the world.



Typical Renewable Energy Control System

### Description

The Renewable Energy Control is a package including an inverter, charge control and display. All the facilities are fitted as standard to make it straightforward to install and to enhance the performance. It is an automatic, integrated and robust system designed and manufactured to give many years of reliable and efficient service.

Powerguard can supply the complete system with the

REC (Renewable Energy Control), PV solar panels or wind turbine or both, connection boxes, isolators and battery. If a complete system is not required Powerguard will supply the Renewable Energy Control system along with other equipment as needed.

The Powerguard Renewable Energy Control system is the complete answer to off-grid systems relying on renewable energy.

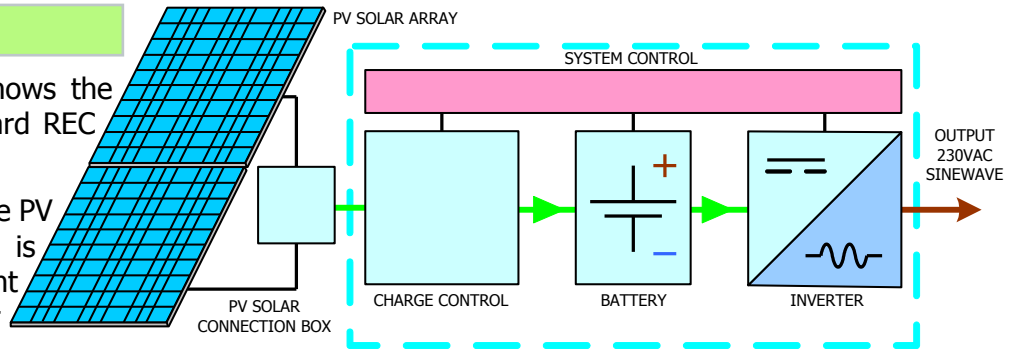
**powerguard**

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## Operation

The diagram on the right shows the main blocks of the Powerguard REC system.

When the sun is shining on the PV Solar Array electrical energy is produced passing current through the PV Solar Connection Box to the REC Charge Control.



Typical REC (Renewable Energy Control) System block diagram

The Charge Control ensures that the Battery is fully charged periodically and is not discharged too deeply. The battery stores the energy that is not being used so that power is available when the sun is not shining.

Systems can be supplied that will work with a mains connection or a standby generator.

## Inverter

The inverter uses energy from the battery to produce 230VAC 50Hz sinewave power to be used in the property. The output is a mimic of mains electricity and will run any mains appliance within its rating.

The inverter fitted into the Powerguard REC system is robust and reliable with a long service life. It is straightforward to service and repair.

The block diagram below shows the main component parts.

The Inverter is microprocessor controlled.

The control monitors the parameters during operation. It generates the waveforms to drive Transformers 1

& 2 via the Power Modules.

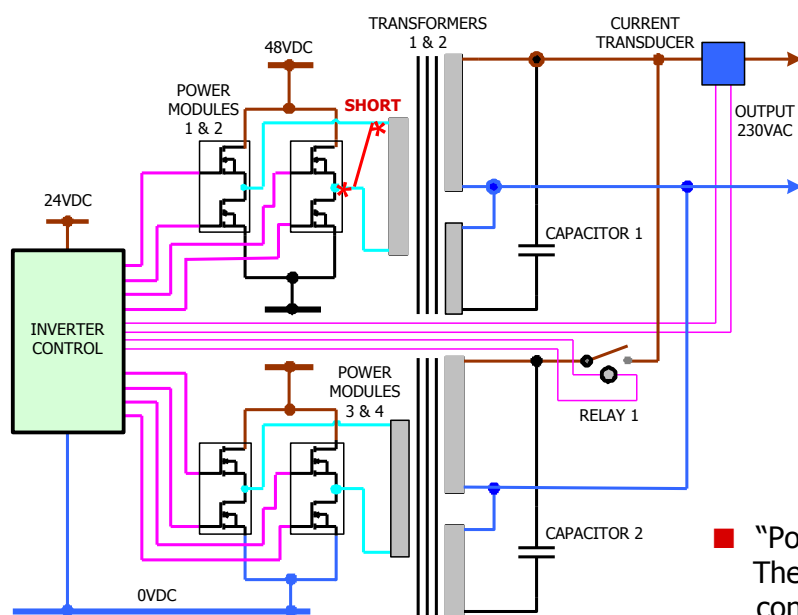
The Power Modules can switch heavy DC currents efficiently and reliably and are rated at less than 50%.

The output of the power stage can be shorted as shown on the block diagram and the power modules will shut down without damage. This is a rare achievement and demonstrates the robust design.

The inverter can be operated at 50% overload for 15 minutes and 25% overload for 30 minutes. The output can be short circuited for 30 seconds and when the short is removed the load will power up as normal.

To increase efficiency one transformer is switched off when it is not needed and switched on again when the load increases.

The output is immune to virtually everything that will be encountered driving mixed and variable loads making the inverter ideal for this application.



Typical Inverter block diagram

## Front Fascia Panel

The front fascia panel is designed to give information, warnings and alarms. The panel gives information to make the system more efficient.

■ "Press and Hold/Inverter On/Off" red button  
The inverter is switched on and off by pressing and holding the red button.

■ "Systems OK" green LED  
The LED is on when the system is OK with no faults.

■ "Output On" green LED  
The LED is on when the inverter is on and the output is live.

■ "Power Supply Fail" red LED  
The LED is on if one of the two DC to DC converters fails. Each converter can power the machine independently.

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## Renewable Energy Control System

Battery Charge/Discharge  
CURRENT VOLTAGE

48.00

PRESS  
AND HOLD  
INVERTER  
ON/OFF

SYSTEM  
OK

OUTPUT  
ON

POWER  
SUPPLY  
FAIL

CHARGE FAIL  
REDUCE  
CONSUMPTION

AUDIBLE  
ALARM  
RESET

CHARGED 2  
CHARGING  
CHARGED 1  
NORMAL  
DISCHARGE  
OVER  
DISCHARGE  
INVERTER OFF  
BATTERY  
CHARGE  
DISCHARGE

### Typical Renewable Energy Control Front Fascia Panel

- "Charge Fail Reduce Consumption" red LED  
This LED is on if the battery has not had enough charge over a twenty four hour period. The solution is to use less electricity to allow the battery to reach the right level of charge. The high charge takes place once per week.
- "Audible Alarm Reset" blue button  
This button is used to silence the audible alarm.
- "Battery Charge Discharge" meter  
The battery voltage and charge/discharge current is displayed. The voltage and current are toggled by pressing the adjacent blue button. The amber LEDs indicate the current status.
- "Battery Charge Discharge" LED bargraph  
The battery is charged using a sophisticated and unique method. Little buckets of energy are counted into and out of the battery so the available capacity is known and can be indicated.

produce power during daylight. PV solar usually peaks at midday.

The load is also variable throughout the 24 hour period.

Powerguard have developed a charge control system that measures the power into and out of the battery in Amp/seconds. Similar to little buckets of energy being put into and taken out of the battery all the time.

The little buckets of energy are counted so the control knows how many buckets of energy there are in the battery at any given time.

The information is displayed on the bargraph and used to manage the system to give reliable operation and maximise battery life.

The system gives a warning if the net energy into the battery is too low over a period of time. This can be rectified by reducing the consumption of electrical power allowing more energy to go into the batteries.

## Charge Control

On most renewable energy systems the batteries do not perform very well and often fail prematurely. This is usually because the system does not control the charge/discharge properly or give the user enough information.

The power produced by renewable energy is variable over the 24 hour period. A wind turbine will produce power when it is windy; PV solar panels will only

## Batteries

Premature battery failure is common on renewable energy systems. So much so that manufacturers are reducing the warranty when the batteries are to be used on renewable energy systems.

Suppliers cite high temperature, excessive cycling and other factors as the cause of the problem. Sometimes these conditions will affect battery life but the main cause of premature failure is because the

batteries are not being charged properly.

Batteries used on the Powerguard REC system will normally have a long reliable life.

Powerguard recommend a battery that has a capacity approximately twice the amount required. This prevents deeper discharges and increases the life considerably. It is false economy to have a smaller battery and work it harder.

Our battery of choice is a wet cell battery similar to the ones fitted on electric fork lift trucks. These batteries are operating reliably all over the world including countries with a warmer ambient temperature. The big advantage with this type of battery is that it can be topped up with suitable distilled or demineralised water.

If a battery that requires no maintenance is preferred or the availability of pure water for topping up is not available then we would opt for a high quality Gel battery suitable for deep cycling applications.

Powerguard can supply a suitable battery with the system.

## Example

A family home in the UK using electricity for cooking as well as all the normal loads, lights, television, washing machines and other appliances, will consume about 500kWh per month. Homes that have fewer electrical appliances will use about 300 to 400kWh per month. In other places around the world where cooking is done using alternative fuels and heating is not normally required the electrical consumption would be below 200kWh per month. The addition of air conditioning would increase this back to higher levels.

Powerguard size systems according to the available power from the sun or wind in a particular area and quote prices for different bands of power.

For example if we calculate a system that will provide 500kWh per month in a particular location in Madrid - Spain we get the following results:

We will allow an o/a efficiency of 70% so we need to generate 715kWh per month.

The output of PV solar panels can be increased by adjusting the angle so they face the sun for most of the time. The figures calculated are with PV solar panels installed at the best angle to give the most

even output over the year. The angle is chosen so that it is both practical and that the worst month has a high enough output. A two axis tracking system would be more efficient and use fewer panels.

We would need 30 x 275Wp panels to comfortably meet the requirement during the lowest power month of the year - December.

A system would include:

- 1 x Powerguard REC system including 5kVA inverter
- 30 x 275Wp PV solar panels
- 3 x PV solar panel connection boxes
- 1 x Battery pack - 980Ah at 48VDC at the 5 hour rate
- 2 x Isolating switches
- 1 x Sundry fixings

## Powerguard about us

Powerguard design and manufacture a range of power systems for Emergency and Prime Power applications.

Powerguard specialise in off-grid power systems for applications ranging from communication hubs, business properties, remote scientific stations, farms and domestic.

Powerguard specialise in integrating renewable energy into the systems where possible. Increasing efficiency and reducing fuel consumption.

We are the largest OEM manufacturer of Static Inverter Central Battery Emergency Lighting Systems in the UK. The systems are installed in hospitals, theatres, offices, factories and many other public buildings.

Quality and reliability are important because many of the systems are operating in critical and safety related applications.

**Practical automatic solutions for saving fuel and reducing pollution. The complete answer to generating power off grid relying on renewable energy.**

**POWER IS OUR BUSINESS  
SAVING FUEL OUR OBSESSION**