

# Off-grid Power Systems

## Built Into Standard ISO Containers

Efficient and reliable N+1 systems for critical off-grid applications requiring 100% power availability.

### Powerguard Off-grid Systems

Powerguard off-grid power systems are suitable for sites where a utility mains electrical connection is either not available or too expensive. Typical applications include: telecommunication hubs, remote monitoring stations, scientific surveys and other commercial applications.

Rugged, reliable and efficient systems with a power availability as near to 100% as is practicable.

The cost of purchasing and installing a Powerguard containerised system can be considerably lower than having a comparable mains connection.

Surprisingly the operating costs can also be comparable or lower than purchasing electricity from the utility mains supply. Low operating costs are due to the Powerguard PS System which is a sophisticated generator and renewable energy control system.

The PS System is designed and built with charge controllers that make efficient use of renewable energy.

Cutting fuel consumption, reducing maintenance and lowering operating costs.

### Powerguard PS System

The heart of a Powerguard off-grid system is the PS System. It is a sophisticated control system that will operate with any remote auto start generator to achieve a fully automatic, fully integrated, efficient and reliable off-grid power system.

It is the most efficient and cost effective solution for providing electrical power off-grid twenty four hours per day seven days per week. The high quality output



A typical 10ft ISO container containing an Off-grid Power System

will power all equipment designed to run on mains electricity. It is very reliable with a long working life of over twenty five years.

The PS system includes a clever control system, inverter, battery charger, battery bank and if possible a renewable energy source. It will provide the maximum amount of electrical power for every drop of fuel consumed.

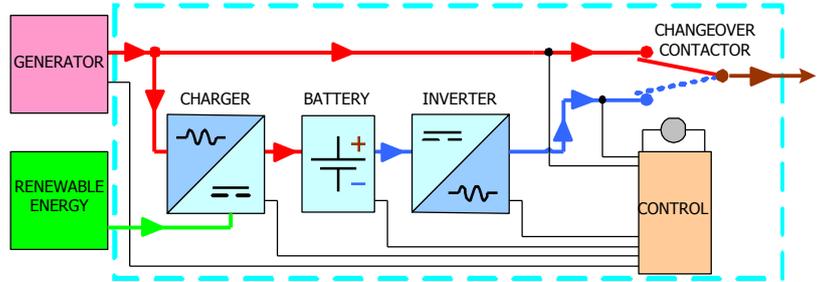
Installed with a renewable energy source in an application providing electrical power to a typical load such as a telecommunication hub, remote station or business the generator will only operate for a small proportion of the day if at all.

When the generator is running the charger uses

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surplus power to recharge the batteries. The PS System will vary the charge rate to suit the load on the generator. If the load on the generator increases the system will reduce the charge power into the batteries and vice versa. This means that the generator load is kept within the most effective band for maximum efficiency.



Typical PS System block diagram

When the generator is not running the load is powered from the batteries via the inverter.

The system is efficient reducing fuel consumption, increasing generator life by at least three times and reducing maintenance by more than two thirds.

The above diagram shows the main components of a typical Powerguard PS System. When the generator is running it supplies power to the load via the changeover contactor. At the same time it also powers the charger recharging the batteries. The path is shown by the red arrows.

When the PS System shuts down the generator the inverter is started and powers the load via the changeover contactor. The path is shown by the blue arrows.

Renewable energy feeds into the system when available shown by the green arrow. It is monitored and integrated into the system reducing generator run time, fuel consumption and maintenance.

## Renewable Energy

The PS System coupled with a generator is an efficient off-grid power system supplying power reliably day in day out for many years.

In fact the standard system on a mixed and varying load can use less fuel over a 12 month period than many competing systems coupled with PV solar. This is because the generator on these systems is acting like a standby and will run uncontrolled for long periods when the energy from the PV solar is low in the winter.

The PS System is already operating efficiently and if a renewable energy source is added then there is an immediate and tangible gain. The generator run time is reduced saving fuel and cutting costs.

The PS System has an input for a renewable energy source such as a wind turbine, PV solar or hydro. The input is accurately monitored and integrated efficiently into the system.

The charger in the PS System is sophisticated and

monitors the Amp/seconds of energy going into and coming out of the battery. Amp/seconds are like little buckets of energy.

The battery is usually recharged every day by the generator and when a renewable energy source puts charge into the battery it is included into the calculations so that the system knows how charged the battery is at any time. The contribution from the renewable energy source will save fuel and maintenance by reducing the time the generator has to run.

In many applications when renewable energy is sufficiently available the generator will not run. Powerguard have a range of tried and tested wind turbines and PV solar panels that increase the efficiency of generator systems.

## Generators

The Powerguard PS System will work with and control any remote auto-start generator that starts when a relay contact is closed and stops when it is opened. If you do not have a generator or your generator is due for replacement purchasing a Powerguard PS Generator should be considered.

They are designed and built to give good fuel economy and are more efficient than the standby generators normally available. For example they use dedicated single phase alternators which can be up to 20% more efficient than those fitted to some standby generators.

The generators also have many other features that make them ideal to work efficiently with the Powerguard PS System. For example the engines are fitted with glo-plugs to guarantee cold weather starting. The fuel system is fitted with a three way valve that makes it straightforward to connect a bulk fuel tank.

Powerguard PS Generators are Prime Power rated not Standby rated. Prime Power means that the generator is rated to be the main or only source of power with

the generator running for longer periods. Standby means that the generator is rated to start and run intermittently when the main supply fails.

Powerguard PS generators are usually fitted with weatherproof acoustic canopies to reduce noise and make them suitable for installing outside if required. There is a cost saving if they are supplied open without the canopy.

## Systems Built Into Containers

Powerguard build different versions of the PS System and generator into standard ISO containers ranging from a standard off grid power system to a sophisticated system using renewable energy.

In this section we will concentrate on the systems designed for supplying reliable and efficient power to remote sites. The systems will use renewable energy to reduce fuel consumption as much as is practicable.

The system is a compact, easily transportable and installed package ideal for permanent, semi-permanent and temporary applications.

It is fuel efficient cutting operating costs and reducing pollution. A typical Powerguard System built into a standard ISO container will comprise of the following:

- PS System with battery pack.
- Smart control system.
- An efficient auto-start generator with an option for a second to give true N+1 redundant
- Fuel tanks.

The PS System is the most efficient system available providing electricity with the minimum fuel consumption.

Less fuel consumption also reduces the logistical problems providing fuel to remote places.

It is the most efficient, reliable and cost effective system available.

## Power availability and reliability

The Powerguard PS System is installed in many locations and is very reliable. Even so in this application the system is designed and built to give a genuine N + 1 configuration.

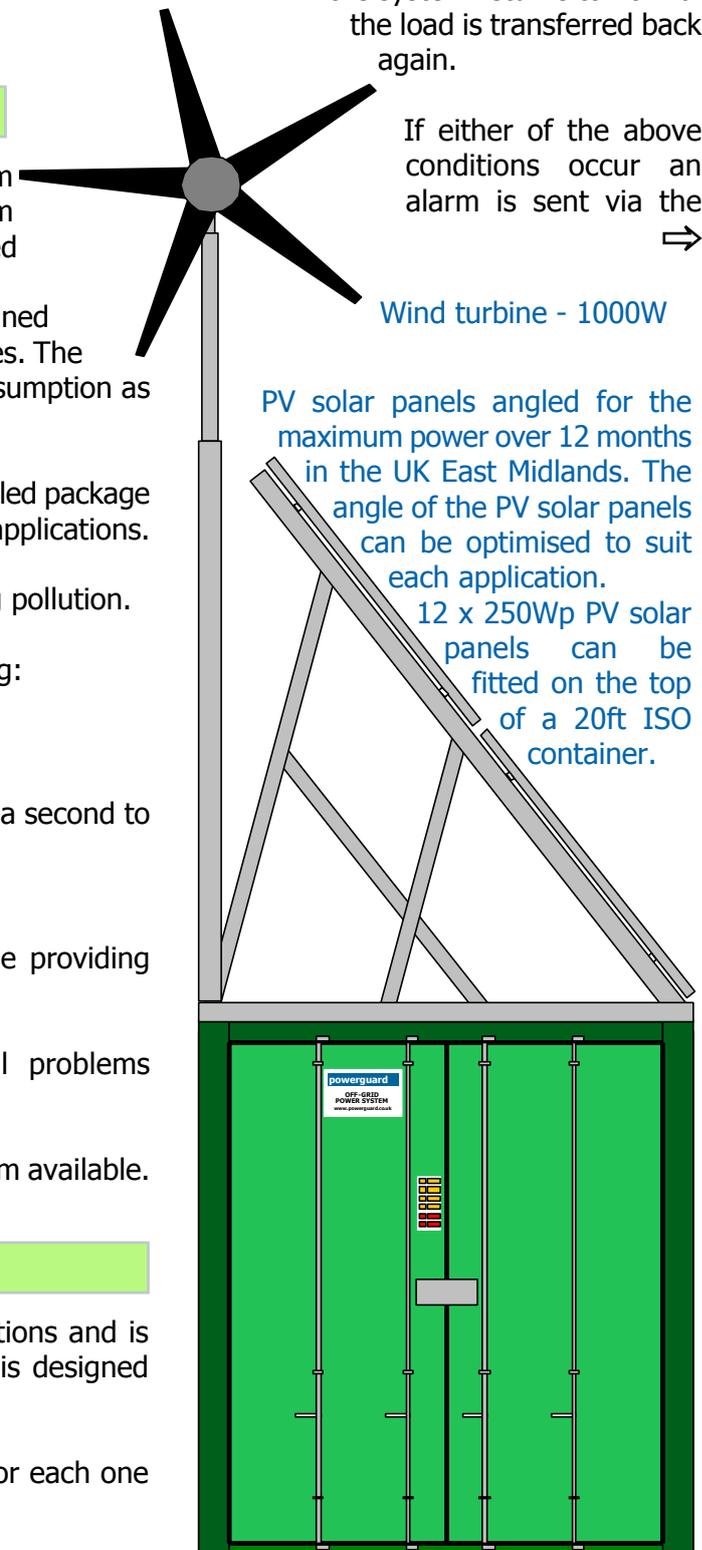
This is done by providing an optional second generator each one sized for the most effective and fuel efficient solution.

The system starts a generator to top up the batteries and provide power for peak loads. If the normally used generator fails to start the alternative is started and will supply the system.

The output is fitted with a specially designed control and changeover system. If the output power fails for a pre-set time the control starts the alternative generator and transfers the load onto it. This is designed as a fail safe operation giving a high degree of reliability.

If the system returns to normal the load is transferred back again.

If either of the above conditions occur an alarm is sent via the →



Wind turbine - 1000W

PV solar panels angled for the maximum power over 12 months in the UK East Midlands. The angle of the PV solar panels can be optimised to suit each application.

12 x 250Wp PV solar panels can be fitted on the top of a 20ft ISO container.

Sketch showing the end view of a standard ISO container fitted with PV solar panels and wind turbine.

GSM network or equivalent for an urgent service visit.

The design ensures that the availability of power from the system is as near to 100% as is practicable

## Alarms and information

The system has a sophisticated communication system sending information and alarms so that preventive action can be taken if necessary.

The following parameters are monitored for external alarms:

- Fuel levels in both tanks.
- Generator starts.
- Voltage and current out of the system.
- System low priority alarms.
- System high priority alarms.

Other specific alarms can be added if required.

## Conclusion

The Powerguard PS System is designed and built to give a cost effective, reliable and efficient power system for remote locations where the availability of power is critical.

The fuel efficiency of the system is optimised to reduce costs and logistical problems.

## Powerguard about us

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

Including a wide range of off-grid power systems for applications ranging from off-grid 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. These range in size from 100W to 100kW single and three phase. The systems are installed in applications including hospitals, theatres, offices, factories and many other public buildings.

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

Powerguard offer a three year on-site warranty on most of the manufactured systems.

Powerguard supply a range of Uninterruptible Power Supplies (UPS) from 100VA to 4000kVA for applications that require continuous high quality power including computers, data centres and telecommunications.

Powerguard supply a range of generators for both Standby and Prime Power applications.

**Practical fully automatic solutions for saving fuel and reducing pollution.  
The complete answer to generating power off grid.**

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



Sketch showing the front view of a standard 20ft ISO container fitted with 12 x 250Wp PV solar panels and a wind turbine.