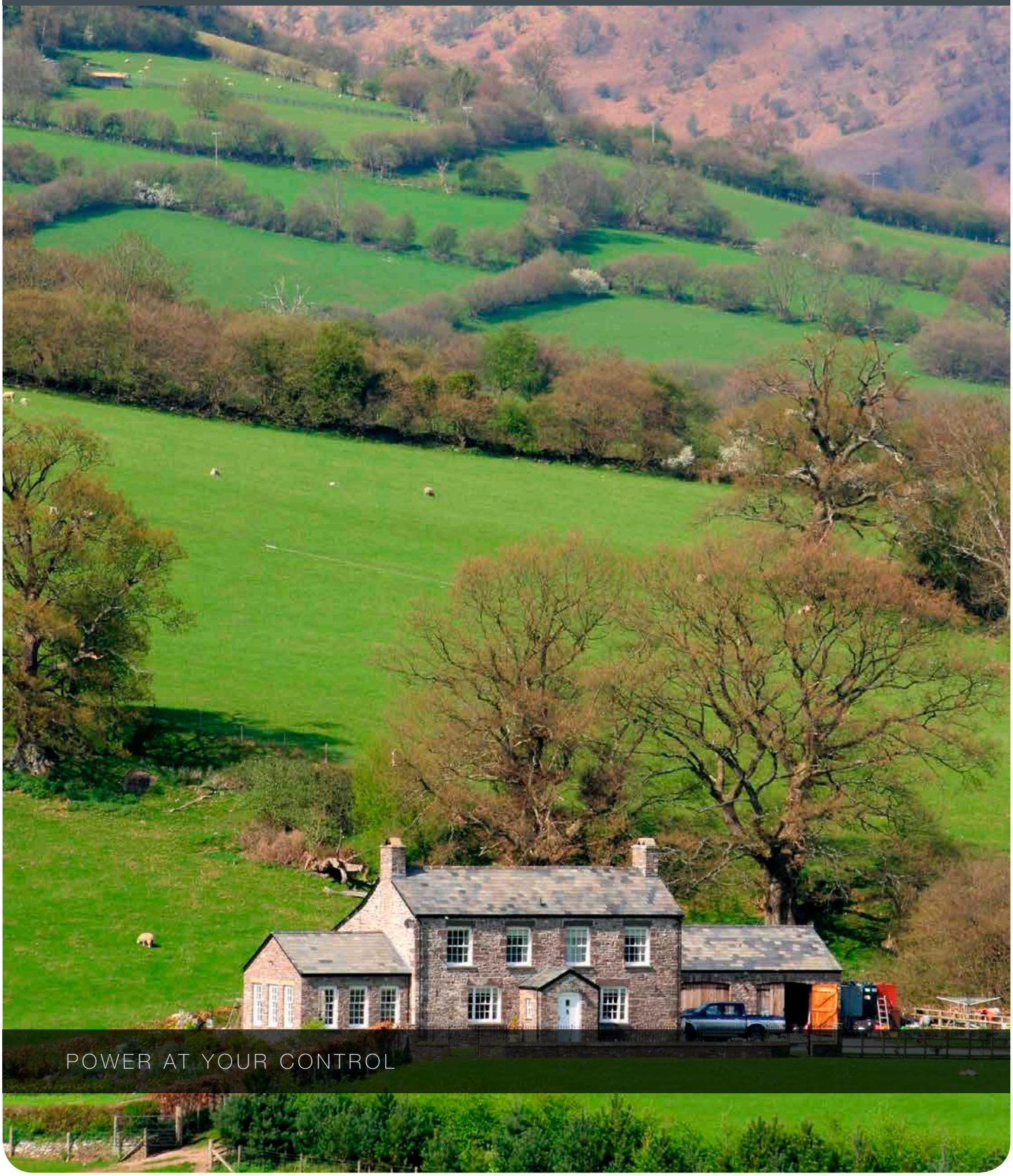
ENERGY SOLUTIONS

OFF GRID POWER SOLUTIONS - RESIDENTIAL



POWER AT YOUR CONTROL

WHO ARE ENERGY SOLUTIONS?

Energy Solutions are a specialist electrical system integrator based in the UK. Established for 18 years, we design, manufacture and supply electrical power equipment for marine, mobile and off grid. For all markets we build innovative electrical and control systems.

The company has over 30 staff with experience in projects of all sizes. Already well established within the UK we now supply our range worldwide.

Energy Solutions manufacture and/or supply:

- Victron Power Electronics
- Rolls Batteries
- Sonnenschein Batteries
- Super B Lithium Ion Batteries
- Northern Lights Generators
- E-Plex - Multiplexing systems
- ES LightNet 5 - Low voltage DC lighting system
- ES Control Panels
- ES ESP Panels
- ES Laser Engraved Panels
- ES TankSenders
- CruzPro Instruments

Contents:

LIVING OR WORKING OFF GRID

Living or working off grid is a lifestyle choice for some, but an economical necessity for many. Even in advanced western economies the grid does not reach everywhere – and getting it extended to reach your dream property can be a surprisingly expensive proposition.

So how can you live a grid connected lifestyle without the grid? Many property owners have done this by installing diesel generators to supply their needs. These either run 24/7 or are turned off overnight. These overnight periods can either be without power, or small loads such as central heating boilers and fridges can be run from a battery supplied inverter.

These systems work well, but there is a cost. Diesel is getting more and more expensive. Long generator running hours also mean frequent servicing and replacement.

Any off grid system will require careful selection. The power supplies are finite – unlike the grid! When considering the capacity of the system you will need to be realistic about your power consumption – including peak power. Under sizing the system will result in power outages and / or extended generator running time. The up front costs of a larger system need to be balanced against the ongoing fuel costs.

The Off Grid systems from Energy Solutions are designed to optimise generator usage – cutting fuel consumption and wear and tear. We can also integrate renewable energy into the system to further drive down your fuel costs (and actually earn you money from the Electricity Company who can't supply you!)

We achieve these savings by using state of the art inverter charger units that regulate the loads applied to the generator to keep it loaded but not overloaded.

Of course the first priority is to be as efficient as possible in your use of energy. Modern 'A' rated appliances, low energy lighting and good insulation will all reduce your demands. The figures and illustrations within this document are all based on 15 KwH of energy usage a day (the average UK domestic usage according to Energy Trends 2007 is 4800 Kwh – 13.15 Kwh per day). Modern homes, built to code 4 of the sustainable homes, can use less than half of this amount.

A good starting reference is the Energy Saving Trust:

energy saving trust®

Visit the **Energy Saving Trust** web site.

Why buy a system?

- The integration of battery monitoring and intelligent control optimises battery life and generator efficiency.
- High power DC systems are wired with very large cables that require specialist tools for connectors. Systems come pre-wired with all of these connectors fitted.
- The main elements of the system are mounted on a common frame to simplify installation on site.
- Service bypass switch for the Multi inverter / charger is fitted as standard.

ES OFF GRID SYSTEM

E-Plex control and optional remote control and monitoring with iPad interface

Energy Solutions are specialists in electrical power systems where there is either no grid or an intermittent grid supply.

We have a proven track record in providing products and support to blue chip customers across a wide range of industries. Since its inception 18 years ago Energy Solutions has developed and installed a range of innovative power management products used in the Industrial, Marine, Solar PV and EV market sectors and has supported products across the globe for many leading OEM's.

Based in Kent, we have a range of Off Grid power solutions that are currently being supplied to industrial and residential sites, providing electricity to areas that otherwise would have no economic access to power.

Our solutions can incorporate the very latest Lithium ION battery technology and our proprietary power management system E-Plex. These systems when coupled with renewable energy sources provide an off grid power source that has unrivalled efficiency both in terms of fuel usage and generator management.

8Kw Off Grid system with Li-ion batteries

ES Off Grid System
The purpose of the E-Plex off grid system is to give you continuous power with the minimum running of the generator whilst maintaining the batteries, storing sufficient energy for a silent night time quiet period. If alternative energy (i.e. solar or a wind turbine) is fitted, the system optimises this energy and allows enough room in the batteries to store the excess for later use and to further reduce the run time of the generator.

E–Plex Control System
To be able to accomplish the above, you need an advanced control system that can monitor many parameters including the charge state, solar generation and the load on the inverter. This information is constantly processed within the control system to see if any action is required.

Overload Protection
To prevent the inverter from being overloaded in high demand periods, the system monitors the size of the load and its duration and calculates if a generator start and assist is required.

Silent Period
This is a user-defined period, such as night time, which restricts the generator from running. However, if the batteries become discharged below a safe level, then the generator will automatically start up, and run to they are at a safe level.

End of Day Top-Up
At the end of the day, a top-up charge is used to ensure that by the start of the silent period, the batteries contain enough charge to run the loads until the end of the silent period, without having to start the generator. The duration of this charge is determined by using the capacity of the charger, and the required change in SOC.

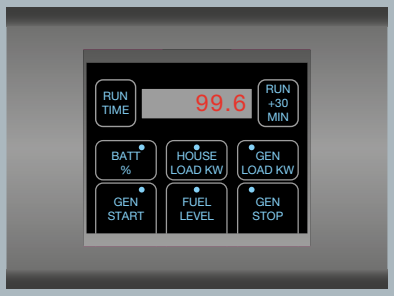
Battery Monitor Synchronisation
In order to maintain the accuracy of the battery monitor measurements, the system will track the time between full charges. If the battery has not been fully charged for more than a week, the generator will run until a full charge is achieved. This will be combined with the end of day top up charge to minimize the amount of additional generator running time.

ES OFF GRID SYSTEM CONTROL

Standard control and optional remote control panels

Standard control and monitoring panel.

The E-Plex touch screen allows full control and monitoring of the system. You can set your silent period, manually start and stop the generator and monitor the battery status.

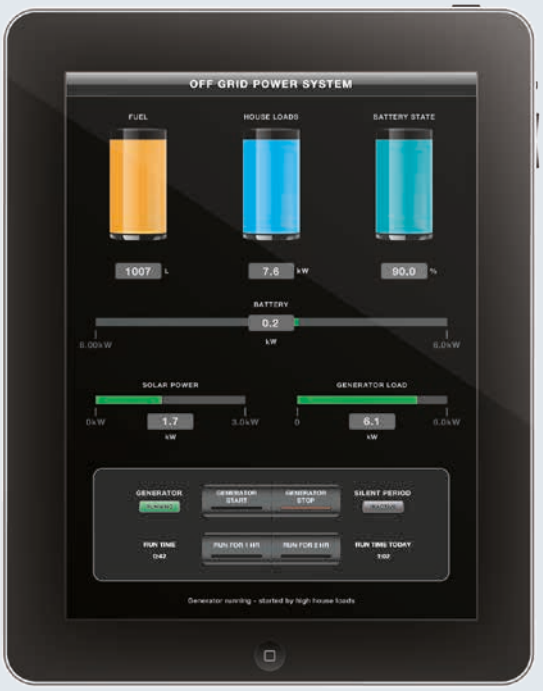


Optional wired remote control and monitoring panel.

The status of the system can be viewed from a remote control panel; this is usually positioned within the house and allows you to monitor the system status and carry out a remote start and timed run of the generator.

Optional iPad remote control and monitoring

Control and monitor your off grid system via your iPad. With our new iPad interface you have a wireless link to view your fuel tank levels, state of batteries, solar power input, generator run times and current timed run as well as a host of other features. This allows you to keep track of all the elements of your system in one place.



The iPad display will show you the following:

- House loads
- Battery state of charge
- Battery load charging/discharging
- Solar power input
- Generator load in KW
- Generator running
- Silent period active or inactive
- Generator run time today and current timed run.
- Text description stating why the generator is running.

WHY HAVE A GENERATOR?

Some off-grid systems do not feature a generator. If the demands are very low or you have a reliable renewable source you can engineer a system without using a generator. These systems can be built up using components that we supply.

However there are a number of reasons why a generator is required:

- Large seasonal variations in renewable energy
- Seasonal changes in energy needs (often you need more power when there is no sun!)
- High peak loads where a generator is required
- A need for having a reliable power source – frozen food, business interruption, heating

Our standard systems are all designed to work with a generator. The purpose of the technology in the system is to use the generator only if needed. This minimises fuel consumption whilst ensuring reliable power.

If you don't want a generator don't panic! We can help engineer a system to suit – however these systems are more bespoke so we can't offer a 'standard' kit.

Why is generator loading so important?

The chart below shows the power consumed from a generator that runs 17 hours a day. You can clearly see the amount of time where the loads are very low. This low loading results in very poor fuel efficiency.

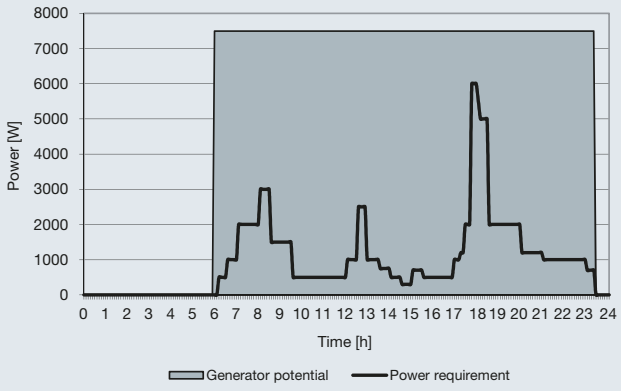
All generators use fuel to just run – even if they are not delivering any power. This means that their actual efficiency is very poor at low loads. We can see this in the table below which shows typical efficiency levels and fuel consumption figures for a 10 Kw generator. These figures are summerised from extensive tests performed by Victron Energy in Holland.

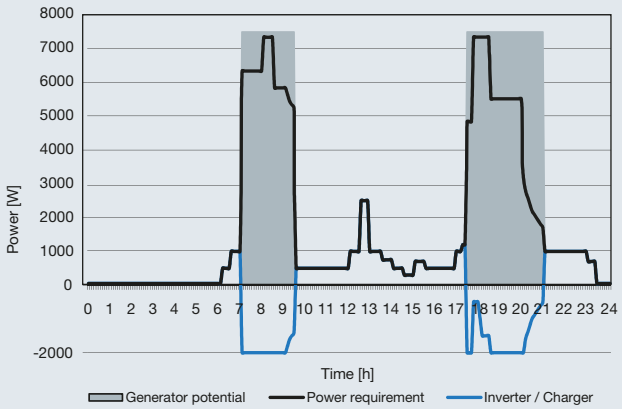
Load applied	Efficiency	Specific fuel consumption (grams per KwH generated	Actual fuel consumption in Litres per hour
0	0%	Infinite	1.06 L/h
0.5 Kw	4%	2200g / KwH	1.22 L/h
1 Kw	8%	1200g / KwH	1.32 L/h
2 Kw	13%	680g / KwH	1.53 L/h
4 Kw	22%	400g / KwH	1.91 L/h
6 Kw	25%	350g / KwH	2.50 L/h
8 Kw	27%	310g / KwH	3.00 L/h
10 Kw	27%	300g / KwH	3.73 L/h

The overall efficiency is based on diesel fuel containing 10.8 KwH of energy in every litre. In the table above, at 1 Kw, the fuel used in an hour contains 13.2 KwH of energy – however the generator has only produced 1 KwH of electrical output – 7%!

If we take a house with a daily average 15 KwH energy consumption we can estimate fuel usage depending on the power system configuration:

By using a battery system to store the energy you can run the generator at high loads, to get the best possible efficiency, and then use the stored power from the batteries at other times.





ES OFF GRID SYSTEM OPTION AND SIZES

Advanced systems for generator optivmisation (automated controls with manual override)

We offer standard systems with 5Kw, 8Kw and 10 Kw inverter chargers at their heart. Consider your needs carefully when looking at the options. The 5 Kw systems are less expensive but the inverters cannot reliably run normal domestic requirements at all times – in other words you may need to run the generator at peak demand times to deliver the power you need. This can mean that you fall outside of the most efficient part of the generators loading.

The larger 8 and 10 Kw and above systems will cost more at first but are large enough to run most houses without a generator. This allows you to fine tune the generator running to save as much fuel as possible.

Whatever size your system, you can run the generator manually if you choose. The inverter charger unit will use spare power to charge the battery as needed and can also 'borrow' power from the battery to boost the generator power if you have occasional peak demands.

The size of the inverter charger also limits the amount of renewable energy that can be injected into the system.

The following table is a good starting point for sizing your system:

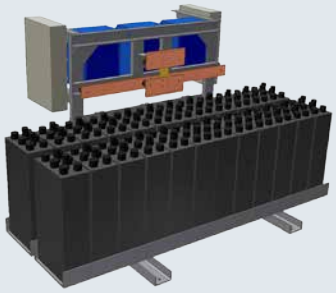
System size	Max renewable	Suggested Generator	Battery Size
5 Kw	3.3 Kw	7 Kw	24v 26.5 Kwh 48v 39.3 Kwh
8 Kw	5.2 Kw	10 Kw	48v 39.3 Kwh
10 Kw	6.7 Kw	10 Kw	48v 53.0 Kwh
30 Kw	20 Kw	20 Kw (Max 36Kw)	
50 Kw	33 Kw	30 Kw (Max 36Kw)	

The 30Kw and 50 Kw systems are used for commercial premises or off grid communities with a shared central generator. These micro grid systems allow small developments to share the capital costs whilst still keeping the system efficient. Each property running from the micro grid will have an export and import meter so the communal costs can be fairly divided. Energy Solutions can tailor these larger systems to suit the particular site requirements.

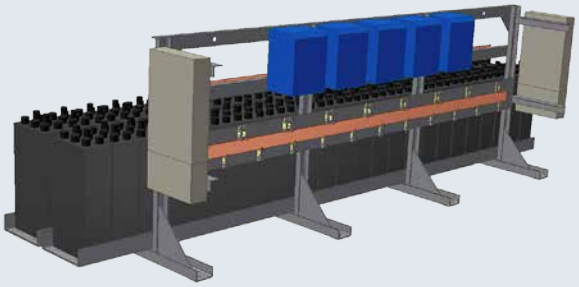
Frame mount system

Containerised system

Custom systems



30Kw System with 48v 3040Ah battery Bank



50Kw System with 48v 6080Ah battery Bank

FUEL CONSUMPTION TEST

We carried out a test that simulated the variable loads experienced in many off-grid applications.

The aim of the tests were to look at running costs, not capital costs, to see how much of a fuel saving our systems offer over running a generator 24 / 7

The hardware
We used one of our containerised 8Kw off grid systems with integral fuel tank and 6Kw generator. Then we added a precision fuel monitor from Flo-Scan in Seattle and our iPad interface. We also added a Victron Global Remote Monitoring system so that data on battery capacity and inverter activity could be logged.

The test
We ran the loads from the system and calculated the litres of fuel per KWh of energy used. The energy consumption varied, but bringing the results back to these figures gives a very good indication of relative efficiencies.

The variables
We wanted to test the benefits of adding a very simple energy storage system for overnight 'silent running' and fuller 'automated' control of the generator.

Solar power was also tested. Energy captured from the solar panels means fewer generator running hours and less fuel burnt.

Different battery technologies were also tested. We selected conventional flooded lead acid (Rolls traction batteries) and Lithium Ion (our own 700 Ah 24 volt bank – 18 KwH).

Test 1: Run the generator 24/7 and see how much energy was consumed and how much diesel was burnt. We ran the test for 34 hours and the results were:

	Amount	Value
Fuel burnt	62.5 litres	
Energy consumed	67.1 KwH	
Litres per KwH consumed	0.93	£0.708
Solar Income	0	£0
Overall cost per KwH	0	£0.708

It showed there is a decent amount of saving to go after. Add the replacement costs of the generator and the costs only go up!

Test 2: Run the generator all day (charging a battery and running the loads) and then run the loads from the battery overnight.

This test was performed with Lithium Ion batteries which we anticipated to be more efficient than lead acid (we tested this later). We ran this test for 5 days and the results were:

	Amount	Value
Fuel burnt	42.6 litres	
Energy consumed	62.9 KwH	
Litres per KwH consumed	0.68	£0.515
Solar Income	0	£0
Overall cost per KwH	0	£0.515

Test 3: The third test was based on running the loads from the inverter and only running the generator when it was needed to recharge the batteries. This meant that the generator was loaded heavily when it did run which kept it's fuel efficiency high and the running hours low. We ran the test for 10 days and the results were:

	Amount	Value
Fuel burnt	123.1 litres	
Energy consumed	309.4 KwH	
Litres per KwH consumed	0.49	£0.372
Solar Income	0	£0
Overall cost per KwH	0	£0.372

The test was repeated with a set of brand new Rolls traction batteries and found that this increased the fuel consumption by over 12%. Bearing in mind that lead acid batteries have a steady decrease in performance we would estimate that Lithium would save 15%-20% fuel costs over the course of their life.

FUEL CONSUMPTION TEST

Test 4: Solar power was added to the same set up as in the third test. This meant that the generator only now runs when the solar fails to keep up with the loads and battery charging duties. We used a 3.6 Kw peak solar system. Again the generator was loaded heavily when it did run which kept it's fuel efficiency high and the running hours as low as possible. We ran the test for 18 days and the results are:

	Amount	Value
Fuel burnt	132.6 litres	
Energy consumed	473.4 KwH	
Litres per KwH consumed	0.28	£0.213
Solar Income	278.7 KwH (£58.53)	£0.124
Overall cost per KwH	0	£0.09

Test 5: More solar power was added to the same set up as the fourth test. It was increased from 3.6 Kw peak to 5.6 Kw peak.

Again the generator was loaded heavily when it did run which kept it's fuel efficiency high and the running hours as low as possible.

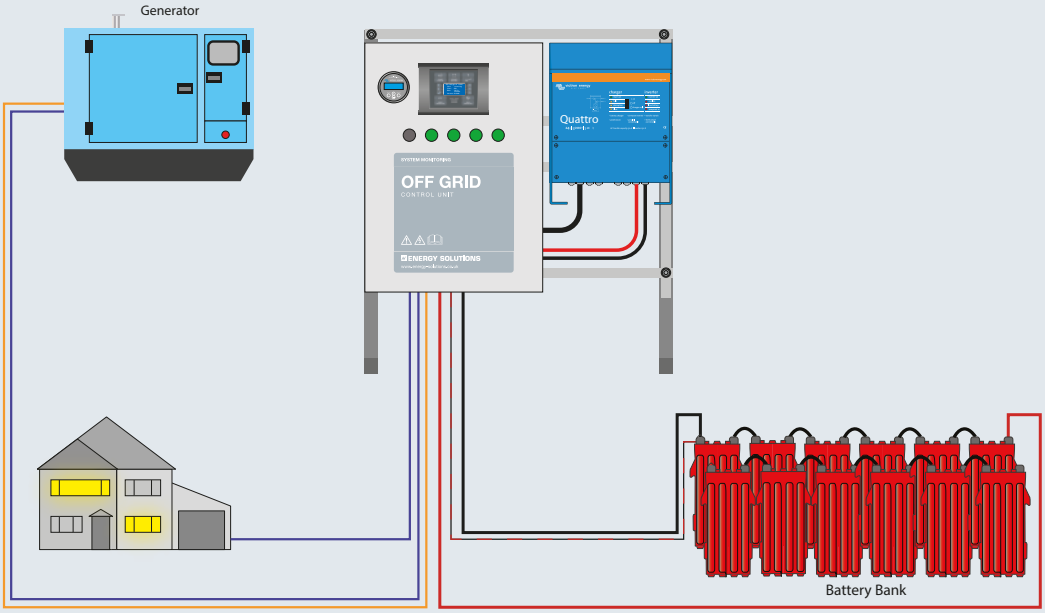
	Amount	Value
Fuel burnt	6.1 litres	
Energy consumed	58.1 KwH	
Litres per KwH consumed	0.10	£0.080
Solar Income	55.7 KwH (£11.70)	£0.122
Overall cost per KwH	0	-£0.12

Conclusions: The tests show that with the correct mixture of renewable energy it is possible to engineer a system that can produce electricity at a much lower price than from a generator on it's own.

It is possible to cut fuel costs by almost 90%.

The results will vary upon the time of year but these figures give a guide to the costs across the year. Recovering waste heat from the generator will improve energy efficiency further still.

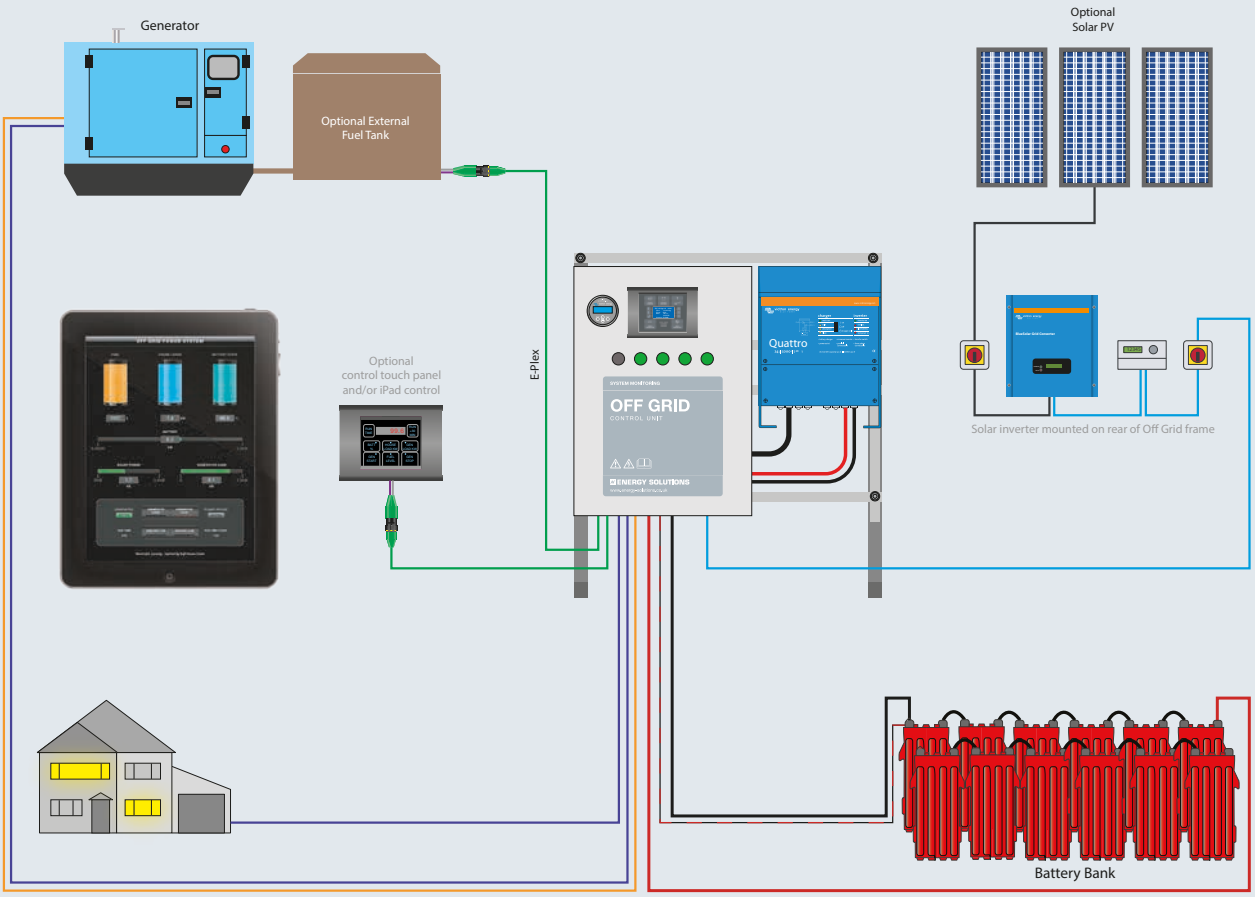
STANDARD FRAME MOUNT SYSTEM



Off Grid System application chart						
System size	Solar inverter limit	Solar panel maximum capacity	Available Frame Mounted	Available Containerised	Suggested Gen size	Solar ready
OFFGRID-EP-FR-SP-24-03000	1.6 Kw peak	No limit apart from working within inverter upper DC voltage limits at open circuit. Normal on grid practice is to oversize panels to inverter by 20%. Normal off grid practice is to increase this further as needed (up to 100% oversize) to maximise yield outside of summer months. This allows the solar inverter to be sized to match the off grid inverter but to have a larger solar panel capacity for increased winter performance.	Yes	Available	3 – 6 Kw	Yes
OFFGRID-EP-FR-SP-24-05000	2.8 Kw peak		Yes	Available	4 – 8 Kw	Yes
OFFGRID-EP-FR-SP-24-08000	4.8 Kw peak		Yes	Yes	7 – 11 Kw	Yes
OFFGRID-EP-FR-SP-48-05000	3.3 Kw peak		Yes	Yes	4 – 8 Kw	Yes
OFFGRID-EP-FR-SP-48-08000	5.2 Kw peak		Yes	Yes	8 – 12 Kw	Yes
OFFGRID-EP-FR-SP-48-10000	6.7 Kw peak		Yes	Yes	9 – 13 Kw	Yes
OFFGRID-EP-FR-SP-48-15000	10.0 Kw peak		Yes	Yes	15 – 20 Kw	Yes
OFFGRID-EP-FR-SP-48-16000	10.5 Kw peak		Yes	Yes	15 – 20 Kw	Yes
OFFGRID-EP-FR-SP-48-20000	13.5 Kw peak		Yes	Yes	20 – 30 Kw	Yes
OFFGRID-EP-FR-SP-48-24000	15.8 Kw peak		Yes	Yes	25 – 35 Kw	Yes
OFFGRID-EP-FR-SP-48-30000	20.0 Kw peak		Yes	Yes	30 – 45 Kw	Yes

STANDARD SYSTEM WITH RENEWABLES

Optional wired remote panel and iPad interface for control and monitoring



Maximising renewables

Our off grid systems incorporate an advanced management system (E-Plex) which allows us to optimise the storage of solar generated power for later use.

Conventional systems start the diesel generator when the batteries become discharged and run until the batteries are charged. This usually occurs in the mid-morning after a night running on the inverter and some high loads at breakfast time.

In these systems it is quite normal for the batteries to be charged by mid-morning. This leaves no room for any solar generated and ‘free or revenue earning power’ to be stored. If your batteries are full, and you are not consuming power the solar will automatically switched off.

E-Plex Control systems work so that the batteries contain enough charge to run through the night silent period without having to run the generator. If there has not been enough generation throughout the day by alternative energies (eg. solar or wind) then the generator will run to top the batteries up. It is calculated by the state of the charge of the batteries and the capacity of the charger. This keeps the generator running time to a minimum and maximises the return from income tariffs, reducing costs.

BATTERY SELECTION

We offer two types of battery technology with our systems. Understanding the way that different batteries work will help you to choose the best option for you.

Deep cycle batteries

Our default offering is a battery bank formed from deep cycle lead acid batteries. These types of batteries are used in forklift trucks, electric vehicles and other high power, high discharge applications. They are conventional lead acid cells, but are designed to cope with deep discharge levels and repeated cycling. Their life expectancy is 2 - 3,200 cycles giving 5 – 10 years.

Lead acid batteries have two characteristics that are important to this application. The first is that the deeper the battery is discharged on a daily basis the fewer cycles you will get. The best price / performance balance is reached by sizing the batteries so that you do not take them below 50% full.

The next characteristic to consider is the rate that the battery will accept a charge. Lead acid batteries can be charged quickly (approx 15% of their capacity) to 80% charged. After this point the rate that they can be charged at gradually drops. This means that getting a battery fully charged takes us into the area of really poor generator efficiency! We cope with this by stopping the automated charge on most days at 80%. This means that we are only using the battery between 50% and 80% in the main. This optimises battery life and generator efficiency – but also means that we are only using 30% of the stated capacity of the battery.

The final characteristic that we need to be aware of is the 'charge efficiency' of a lead acid battery. We know that we can store energy in a battery. However the bad news is that you don't get back all the energy you put in. In fact the efficiency is around 75% for a lead acid battery. This means that 25% of all energy generated from a diesel genset or solar system, if put into a battery bank, is lost as heat. Remember, however, that this charging efficiency is much less of a problem than running the generator lightly loaded!

Lithium Ion batteries

Our upgrade option for batteries is Lithium Ion. These batteries carry a significant up front cost. They are available in different formulas, but are used in electric cars, smart phones and power tools. Their life expectancy is 2 - 4,000 cycles giving 5 – 10 years.

Lithium Ion batteries differ in their characteristics from lead acid. They suffer less with reduced life through deep discharge (in fact charge 'quality' is the most important issue with battery life). This means that we can use all the stated battery capacity.

The next difference is the rate that the battery will accept a charge. Lithium Ion batteries can be charged very quickly (approx 100% of their capacity) all the way to 100% charged. This means that getting a battery fully charged presents no problems with generator efficiency. This means that we can now use 100% of the stated capacity of the battery.

The 'charge efficiency' of a Lithium Ion battery is also dramatically improved – it is 98%. This means that almost all the precious energy generated from a diesel genset or solar system can be used.

The cumulative effect of these differences in characteristics is a dramatic difference in the battery sizing for the different technologies.

If we take a 1,000 Ah lead acid battery as a reference we can calculate the following:

- To optimise battery life and generator loading we operate the battery between 50 and 80% - effectively we use only 300 Ah of capacity.
- Of this 300 Ah of capacity 25% is lost through the charge discharge process. We can either view this as lost energy in or a further reduction in battery capacity to 225Ah.

This means that a 360 Ah Lithium Ion battery offers significantly more useable power than a 1,000 Ah 2 volt battery bank in this type of application.

GENERATOR OPTIONS

We are happy to work with any generator. If you are choosing a generator we suggest you consider the following:

- **Generator running speed** – Generators are built to run at either 3,000 Rpm or 1,500 Rpm. The slow speed sets will be much more durable as ½ the engine speed means the unit 'travels ' half the distance every hour it runs. The forces in the engine are also reduced exponentially meaning that it travels half the distance every hour but should also be able to do a much longer distance. A good expectation is for a 1,500 Rpm machine to last 4 times the hours of a 3,000 Rpm machine.
- **Duty cycle** – generators can be built for occasional 'stand by' use where they are expected to only operate a small number of hours a year or for 'prime power' where they are expected to be operating long hours – even 24/7. Stand by machines are not designed for the duty expected in an off grid application.
- **Autostart** – An Autostart system is required for the automated off grid systems. An autostart system can take a signal from our system and then correctly take the generator through the pre-heat and crank cycle to start the generator.
- **Fuel efficiency** – Look carefully at the fuel consumption figures at full and half load for the machine you are looking at. Fuel saved can justify spending that bit more on the generator.
- **Heat recovery** – If your property can utilise any waste heat from the generator then you need to make sure you can capture that energy. This will be a combination of jacket water and exhaust gas heat recovery.
- **Simplicity** – Remember that this machine is an essential part of your power system. A simple, reliable machine that can be easily maintained and repaired is important.
- **Fuel system** – Spend money on good filtration and fuel conditioning. Most diesel generator problems are fuel related. Money spent on fuel filtration will be paid back many times!

What we offer

We offer Northern Lights, Caterpillar and SDMO generators. We can offer these machines with heat recovery and, of course, auto start.

Features

- Four cycle, 3 cylinder liquid cooled, naturally aspirated, overhead valve, industrial-duty diesel.
- Indirect injection with glow plugs for fast cold weather starts.
- Based on heavy-duty tractor engine blocks customised for optimal prime power production.
- With proper maintenance they have logged over 25,000 hours.
- Low torque operating at 1500 at 50Hz, they exhibit less wear and tear than the competitors' light weight intermittent duty 3000 rpm gensets.
- To ensure ease of maintenance all key service points are on a common side. Low oil pressure and high coolant temperature shutdowns protect your investment.
- Liquid cooled with radiator and pusher cooling fan. Steel radiator shroud and fan guard protects the radiator and operator.
- Four centre-boned mounts isolate vibration.
- Large, replaceable air filter protects engine in dusty environments.

SAVING EVEN MORE WITH RENEWABLES

So far we have just looked at optimising generator usage. However we can save yet more precious fuel by integrating renewable energy into the system.

Solar panels generate DC power that can, via a solar regulator, charge a battery. However we can replace a solar regulator with a solar inverter that will convert this DC power to 230 v AC. This power can then be fed, via a power meter, to our system where we can use it to run household equipment or charge the batteries. If done this way (and installed by an MCS accredited installer such as Energy Solutions) the power generated is eligible for the government backed Feed in Tariff (FIT). You will get paid for every kilowatt hour the system generates (the rate is currently 2 - 4Kwp is 14.9p per KwH and 4 - 10Kwp is 13.5p per KwH)

A 4 Kw solar system will generate approximately 4,484 KwH per year. This will earn you £435 from the Feed in Tariff and could save you (assuming you are getting 20% efficiency on average from your generator) a further 1,500 litres of fuel if you could use all the solar energy generated. In reality there will be periods in the summer where the system generates more than you use so, whilst we can engineer the system to almost guarantee the £435 FIT we should assume that we will only realise 65% of the fuel saving.

Of course you will find the generator running more hours in the winter when the days are short and the sun low in the sky. However there will be days in the summer when the generator will not need to run at all. We have a system in use in a 3 bedroom remote house and a 4 Kw solar system where the client has recorded weeks in the summer with less than 2 hours generator run time.

Can even more be saved?

All the figures above can be improved further – by energy saving! If you don't use it then you don't need to generate, store or convert the energy. Whilst you may not want to change your lifestyle if living off grid at first it can soon become a satisfying obsession to reduce your fuel consumption and our systems can help you with that!

Whilst we have focused on electrical requirements in this overview there is an obvious opportunity to capture some of the wasted energy from the generator by using that waste heat to contribute towards heating water and heating the house. The 75% of the energy 'wasted' by the generator is lost as heat and noise. Not all of that heat can be fully recovered – but a lot can! We can help you integrate this waste heat into your system.

Off Grid House and stable complex

Solution

- 1x 24/5000/120 ES Off Grid Kit
- 1104 Ah batteries at 24V
- 1x 11KVA Generator

Due to the cost and difficulties in connecting to the National Grid, we were approached by a customer to design and commission an off grid system in a large rural dwelling and stable complex. The system had to be completely automated, providing 24 hour continuous power.

The customer initially considered installing a large generator, and running it continually. However, it soon became apparent that this option would be costly, noisy and inefficient.

Instead, the customer opted for a standard Energy Solutions's 5kw off-grid kit, who's features fitted his requirements. Subsequently, Energy Solution supplied the kit, configured with the customer's specified configuration and generator run-times. This was then installed by a local electrician.

The system now provides the customer with a comprehensive management of the generator running times , including pre-defined runs , a weekly synchronisation charge, a silent period (ie. Night-time), automatic generator running if batteries discharge becomes low or if there is an unusual high load demand. Within the house is situated a control panel, which provides the customer with information regarding the status of the system, and allows him to remotely start/ stop the generator.

The system has significantly reduced the running hours of the generator, but still provides 24 hour power. It is expected that the ES Offgrid system costs will be recovered within 3-4 years due to the savings in diesel and servicing costs.

Off Grid System for Oxfordshire Barn

Solution

- 3x MultiPlus 48/3000/35
- 820Ah Batteries at 48V
- 5.85Kwp Solar Panel array
- Solar Inverter
- ES DC Link Box
- BMV600 Battery Monitor

For some businesses the best option for new operations are remote locations. This proved to be the case for a client based in Oxfordshire that wanted to start breeding game birds on their farmland.

A barn was purpose built for the new operation but being in the middle of field connecting to the grid was not an option. Off grid power was seen to be the most efficient way to supply the heat and light required for the breeding and housing of the birds throughout the year.

Space was of a premium within the barn so the off grid system needed to be kept external to the building. Solar panels were installed by a local supplier and Energy Solutions designed a complete storage, monitoring and control system housed within a dedicated container.

Remote Home in Lincolnshire

Solution

- 5kw Victron Inverter / Charger
- 7kw Northern Lights Generator
- 1100Ah Rolls Batteries
- ES Remote Panel

The client owns a detached property in a rural part of Lincolnshire. He had always relied on an off-grid system to provide the power for his home. However, his existing system proved expensive, noisy and unreliable, and frequently required him running a generator for 16 hours per day.

After learning about Energy Solutions range of Off-Grid systems, which focused on reducing generator run times, the customer contacted us. We undertook a site survey to establish his power needs, peak loads and consumption, present and future. It was decided to install a 5kW off grid kit, a 7kw Northern Lights generator and 1100Ah Rolls batteries. This was perfect for both his current needs and future requirements, whilst allowing for solar panels to be added at a later date as the client's budget allows.

To make the system convenient, and easy-to-operate, the remote control panel was located in the kitchen area. The client could therefore monitor the system at all times, and if needed, carry out a remote generator start-up from inside the house.

The off-grid system was installed in a small outbuilding. Installation took one day to complete, and it was operational immediately.

The biggest savings for the customer is the reduction in generator running times, and fuel costs. It is estimated that his fuel costs have been reduced by £5k per year, as the new system generator will be running for only 3 hours per day, resulting also in a quieter home environment.

Silent power for remote home in Kent

Solution

- 5kw Victron Inverter / Charger
- 2kwp Solar (PV)
- 2kw Victron Solar Inverter
- 1100Ah Rolls Batteries
- ES Remote Panel
- Customer's Generator

We were approached to supply an off grid system for a weekend retreat home in a remote location in Kent, in Spring 2012. At the time the owner was solely using a generator to provide power, but this was proving to be a noisy and uneconomic option. The main requirement of the new off grid solution was to have near silent running with only minimal use of the generator.

Our solution was to supply a standard Energy Solutions 5Kw off grid kit with the addition of 2Kwp of solar. The generator will only run if there is a shortage in energy produced from the solar.

The roof mounted solar panels were designed to have a minimal visual impact on the home. Positioned within the roof gully to be as unobtrusive yet efficient as possible they were installed and commissioned by our own MCS registered team, allowing the customer to claim an income from the Government's generation tariff for the power created.

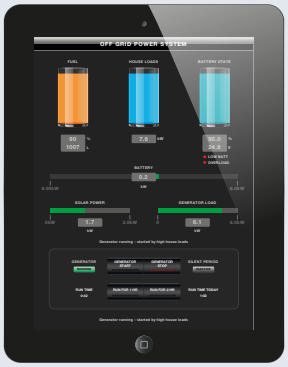
The system has been running throughout the summer with all energy being provided silently by the solar, any excess energy is stored in the batteries for use later. During the winter when there is less sun the batteries will be charged during the week ready for weekend use.

Scottish Highlands Home installs Off Grid System and Maximises Renewables Efficiency

I choose the Energy Solutions system due to it's user functionality, versatility and ability to link in with renewables.

Jamie Robinson

Jamie Robinson has lived in an off grid situation all his life. He chose the Energy Solutions' Frame Mount Off Grid system over other solutions available due to its user functionality, versatility and ability to link in with renewables.



Some of Energy Solutions Off Grid systems have a semi-bespoke design to ensure they match customer's exact requirements, Jamie's was one such example. The kit consists of a 5KW Victron Quattro inverter, linked to an SDMO 5KW auto start generator with a Rolls battery bank of 1100AH at 48V. The off grid kit starts the generator when required. The kit is linked with grid tied renewables: solar & wind.

Overall the kit provides an artificial grid and the renewable power is used in the property first with any leftover being diverted back to the batteries. The generator running times are set to maximise renewable options. For example it will not run the generator and achieve a full charge to the batteries first thing in the morning so as to maximise the potential solar yield.

The inverter also has a "power assist" function and it will use the generator as backup thus giving 10KW of available power. Waste heat from the jacket water of the generator exhaust are used to heat domestic hot water and also the poly tunnel in winter.

As an experienced engineer Jamie was able to install and commission the system himself and is more than happy to demonstrate and talk through the system to anyone in Western Scotland who is interested in an off grid solution.

"My business is working with alternative energy, after looking at other options I have found the Energy Solutions' Off Grid approach to work the most effectively. So much so that as well as installing it for my own home, I recommend and install them for my own customers in Western Scotland." If you would like to contact Jamie to discuss the Off Grid system you can reach him via his website: www.alternativeengineeing.co.uk

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