

OFF GRID SOLAR GUIDE



SUNERGY
SOLAR & BATTERIES

1300 4 OFFGRID
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WELCOME TO OUR OFF-GRID GUIDE!

The guide is written for people who are considering off-grid living and want to know how it works, what is involved and how to get it right the first time. The same principles apply to RV systems as they are just smaller versions of an off-grid system aka “off grid lite”.

We hope you find the guide useful.

CONTACT US

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Victorian Registered Electrical Contractor REC-24310

WHY OFF-GRID?

Most people want to go off-grid because the cost of an electricity connection to their property is excessive. In many regional/rural areas, new connections often exceed \$50,000. In others, a grid connection is simply not available.

Grid connection costs depend on how far the residence is from the existing electricity network. The greater the distance, the higher the cost for new poles, wires, and transformers. In many areas, new connections must be run underground due to bush fire risk.



HELPFUL TIPS

Powercor have an online estimation tool for new connections. Please note the tool estimates the cost of running power to your property boundary and excludes the cost from the property boundary to your residence:
<https://customer.portal.powercor.com.au/mysupply/CIAWQuickCalculator>

Other than cost, reasons for exploring off grid might include:

- The grid cannot provide sufficient power for your needs.
- The grid in your area is prone to outages; example the property is at the end of a SWER line.
- The grid can only provide single phase and you need two or more phases.
- Personal choice/philosophical reasons



HELPFUL TIPS

If your concern is grid capacity or reliability, Sunergy can assist with alternatives which may be more cost effective than a full off-grid system. Options include grid connected batteries and/or standby generators.

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HOW DO OFF-GRID SYSTEMS WORK?



There are 3 main components to an off-grid system:

- **Renewable power generation source(s):** Options include solar, wind and hydro. Although there are alternatives nothing competes with solar for simplicity, reliability, and cost effectiveness. Solar's advantages include that we know the sun will come up in the morning, no moving parts, minimal maintenance, and solid warranties. Rebates on solar are considerably greater than other technologies.
- **Energy storage:** This means batteries. Tried and tested battery chemistries include lithium and lead acid (flooded, gel and AGM). The most common battery chemistry for new off grid systems is lithium. Battery chemistry is discussed in more detail in our off-grid newsletter available here: <https://www.sunnergysolar.com.au/free-off-grid-newsletter/>
- **Backup generation:** While possible to design an off-grid system without a backup generator, this comes with unpalatable trade-offs. No backup generator generally means one of two things are necessary:
 - Severe limits to power consumption in poor weather, and even then, you may still run out of power.
 - A significantly oversized battery bank to tide you over in poor weather. Central Victoria can have up to 11 days of concurrent cloudy weather in June and July which would require a large battery bank to tide you over. The cost of this would be far more than a quality backup generator.



HELPFUL TIPS

The pros and cons of alternative generation sources, battery chemistry options and backup generators are discussed in more detail in our off-grid newsletter. Want to know more? Go to <https://www.sunnergysolar.com.au/free-off-grid-newsletter/> to subscribe.

WHAT IS THE PROCESS?

Step 1 - Load Profile: When considering off-grid, you are in essence building a power station. To get this right, we need a specification of how much power your power station needs to deliver by hour by day and by season.

Our experienced and accredited off-grid designers will spend time with you understanding in detail what appliances you are looking to power. We will drill down into the time of day of usage and seasonal variations. By knowing the time of day, we can design your system to run daytime usage appliances from the sun. Night-time usage appliances will need to come from your battery bank. If you have heavy usage appliances, it might make better sense to run these from a generator, especially if budget becomes a constraint.

The load profile usually takes 1-2 days of our time to get right. Along the way you will get the benefit of advice from our years of experience on appliance selection and how to do things such as hot water (solar may not be the best answer); black water treatment (which solutions are off-grid friendly); heating and cooling (a couple of split systems may be more off-grid friendly than a ducted system etc).

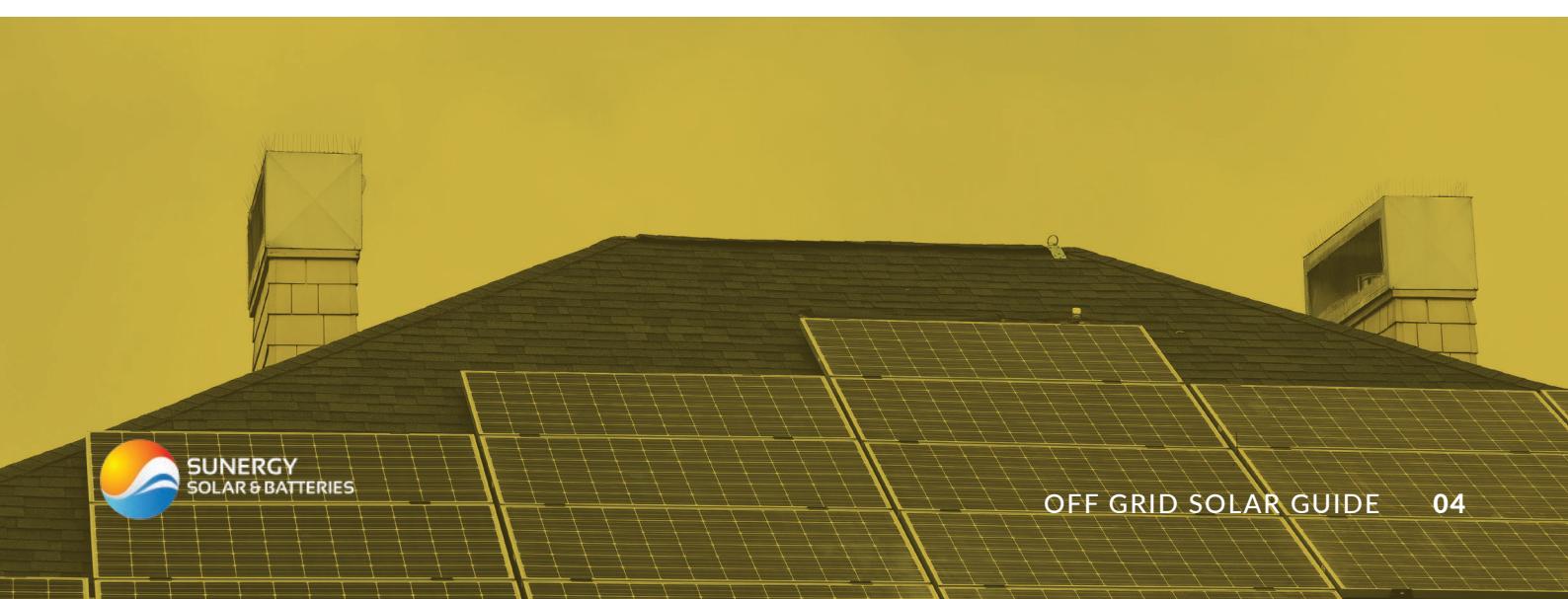
Step 2 - Site Assessment: For local existing sites, we will visit your site to determine locations for equipment, shade, roof sizes etc. For new builds or remote sites, we work from site plans and aerial images.

Step 3 - Design: Now we know your energy requirements and site details, we develop a system design. We use specialist design software from the USA, we determine how much solar, battery and generator capacity you need to reliably meet your power and budget requirements. Where compromises are needed between cost and function, we walk you through the options and provide clear advice as to what that means. As an example, if your budget means less solar or less battery than "perfect", we calculate what that means in terms of additional generator run time by month and additional fuel cost. Alternatively, it may mean selecting an alternate energy source for some high usage applications.

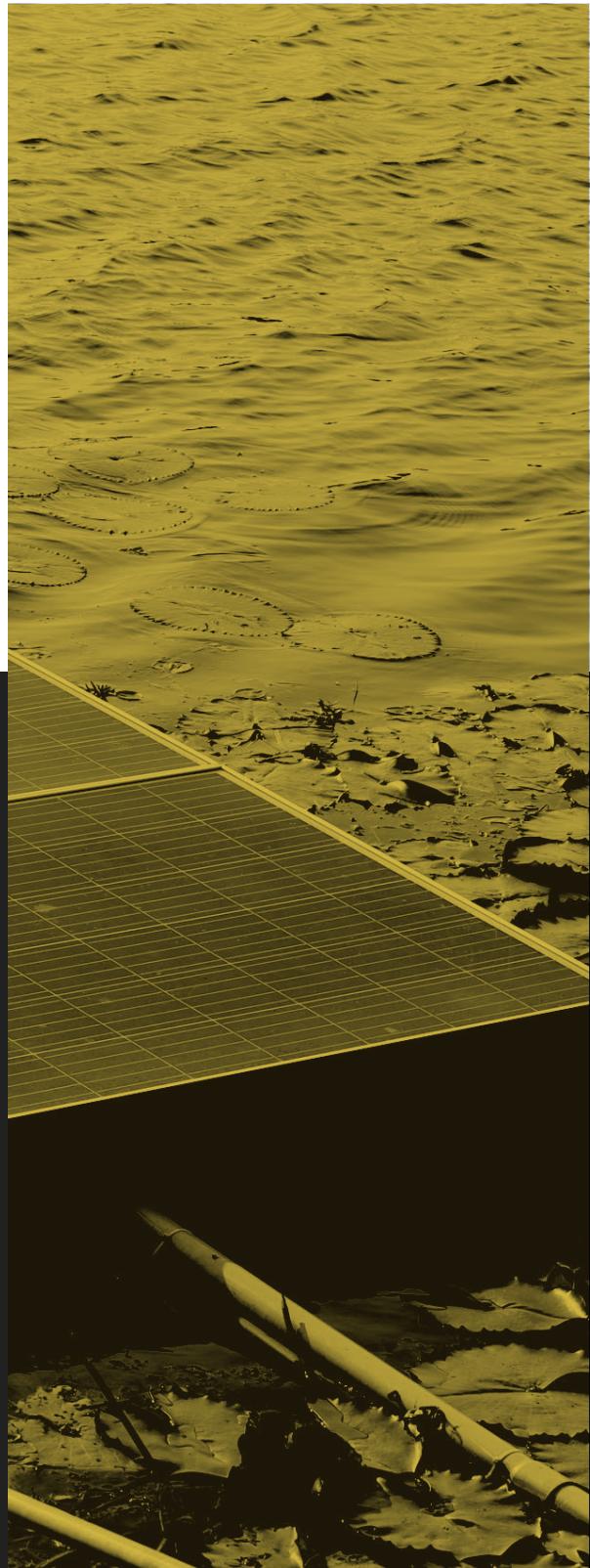
Step 4 - Build: We pre-build and configure systems in our factory. This reduces time on site during installation and means we can build a system for installation by your own electrician if you are outside our service area. Look at some of our work in our gallery: <https://www.sunergysolar.com.au/off-grid-gallery/>.

Step 5 - Install: We offer complete installation by our accredited and qualified staff. Or if you choose, you can purchase a pre-built system and have it installed by others.

Step 6 - Service & Monitoring: We can include internet monitoring and remote support capability on our systems. Remote support reduces cost of ownership by saving on call out and travel costs in many cases. We also offer system servicing and maintenance.



ENGAGEMENT



**THE REALITY IS, GETTING THE LOAD PROFILE
RIGHT IS CRITICAL TO THE DIFFERENCE
BETWEEN HAPPINESS AND GUARANTEED
FUTURE MISERY.**

We get calls all the time from people who have been sold a pup. Fixing a mess is expensive, especially with no-name brand equipment from eBay. Ironically fixing the mess means starting with a load profile followed by a new design. Getting it wrong the first time around means paying twice.

Sunergy is prepared to invest in the success of genuine qualifying prospective customers* by working with them to create a professional load assessment. What you're getting here is the time and experience of one of our experienced and valuable off-grid designers with 10+ years of experience. The value of this service at typical charge rates is \$1760+.

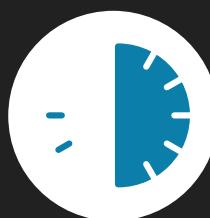
* Terms and conditions apply

COMPARING OFF GRID PROPOSALS

To comply with Australian Standards, an off grid proposal MUST include the following metrics:



kWh per day to be delivered in summer and winter.



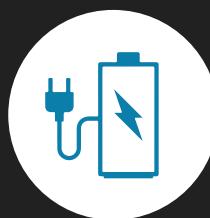
Half hour maximum demand (kW or amps)



Generator run time by month and fuel usage.



Percent of the load supplied by renewable sources in winter and summer.



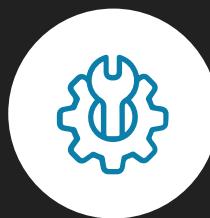
Daily battery depth of discharge and estimated lifespan



Days of autonomy before a generator is needed due to low battery state of charge.



Brands of equipment being supplied.



Proposed monitoring and remote support solution



Has the system design taken panel and/or battery degradation into account? Sunergy can give you the expected performance of your system when new and when (say) 5 or 10 years old.

Your off-grid supplier will be your electricity company for the next 10+ years. Therefore it makes sense to check they have the capability to support you. For example, many off-grid suppliers are one-person bands; what happens when they go on holiday? We've prepared a checklist for you to consider:

FACTOR & WHY SHOULD YOU CARE?	SUNERGY	ALTERNATIVE SUPPLIER 1	ALTERNATIVE SUPPLIER 2
Is your supplier a Registered Electrical Contractor (REC)? Under Victorian legislation, only RECs are permitted to supply electricity services.	✓ REC-24310		
Resources: If your supplier uses contract installers or is a one-man outfit, they won't be able to support you when they're on holidays etc.	✓ Sunergy has six qualified off-grid technicians		
Lifetime internet support: If your system is on the internet and your supplier is set up to provide remote support, most problems can be sorted without needing boots on the ground. That means a far more rapid response because site visits don't need to be scheduled. It also means lower costs to you because very few people will perform service calls without charging for time on site and travel.	✓		
Did they perform a load assessment? If you don't have a load assessment, how do you know what the proposed system is capable of delivering?	✓		
Does your supplier employ its own installers? Are the installers off-grid solar accredited? Sub-contractors are unaccountable and the more they rush things and take shortcuts, the more money they make. Having our own installers means we don't have to find someone to help with post installation problems.	✓		
Is your supplier experienced? Can they provide references? Are they accredited and experienced with the equipment being offered?	✓ Sunergy has been doing off-grid solar since 2010. All of our installers have off-grid systems in their homes. We are pleased to arrange references. Sunergy installers are trained and have qualifications from Victron and Selectronic.		
Does your quote advise the core performance criteria outlined in "Comparing Off-Grid Proposals" above? If not, your quote does not comply with AS 4509 (Stand-alone power systems). How do you know the proposal meets your needs?	✓		
Is your installer a licensed electrician? Many small off-grid installers are not electricians. By law, anything more than 100V or 500VA requires a licensed electrician. Unqualified people performing prescribed electrical work on your home are significant insurance risks.	✓		

THIS IS ALL VERY NICE BUT HOW MUCH WILL IT COST?

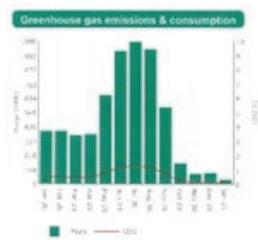
Cost comes down to how much power you need.



HELPFUL TIPS

To estimate how much power you use, grab a hold of your current power bill which will contain a usage graph like this:

Using this graph as an example, we can see January (summer) consumption is $436/31 = 14\text{kWh/day}$ and July (winter) is $1090/31 = 35\text{kWh/day}$.



Assuming your new off grid home uses the same energy sources for heating, cooling, and hot water, this would be a good starting point. Having said that, if you are using 35kWh/day in winter, the best place to start is to work out how to reduce that because a system that size is not going to be cheap. If it were 14kWh/day winter and 35kWh/day in summer, it would be far less of an issue.

As a rule of thumb, a system to deliver 5kWh/day with an even split of day/night consumption will cost approximately \$25k. 10kWh/day will cost approximately \$40k.

Above this, economies of scale start to take effect – for example 30kWh/day would be approximately \$75k. These price estimates do not include a generator.

An RV system for a caravan etc starts from \$5000 including standard installation. This would deliver 0.5kWh/day and include an 800VA inverter, an AC to DC battery charger, Anderson outlet, twin USB outlet AND certificate of electrical safety. Upgrade to lithium available.



UPGRADEABLE SYSTEMS

We regularly get asked about upgradeable systems for people who may be:

- Starting with a holiday house now but aspire to move there later.
- Building so want to spread the cash outlay.
- Cash constrained in the short term and want to add on to their systems over time.
- A couple planning a family.

The reality is it is far better to plan a system to be upgradable from the beginning rather than try and figure out how to upgrade one later.

The key impediments to upgrade are traditionally battery banks and many equipment suppliers bringing out new models which are not backward compatible with their previous efforts. Lead acid battery banks are difficult to upgrade because new lead batteries do not like being added to old ones and the only upgrade path is to double the existing. Lithium is much easier to upgrade except for if manufacturers release a new model which is not backwards compatible with previous products.

All our off-grid systems using our preferred brands are upgradeable.

THE SMALL BATTERY BIG SOLAR MYTH

The game being played here is to produce proposals with oversized solar arrays and undersized battery banks. This game is played on the unwary to produce seemingly too good to be true proposals.

How it works is that there are generous rebates on solar but not on batteries meaning means “big solar small battery” proposals look cheap. The spiel is that you do not need a big battery because even in cloudy weather you will get “something”.

Let us unpack this line of thinking

- If the designer has a professional load survey, the maths will quantify your night-time loads.
- Battery specifications will state the maximum depth of discharge, cycle life and maximum continuous discharge and surge current (amps).
- Battery warranties will state how many cycles per day and depth of discharge are permitted to retain warranty.
- If it is a lead acid-based battery bank (flooded, gel, AGM, lead carbon etc), the chemistry will only be able to keep up a discharge rate of around 10% of the battery capacity before voltage sag becomes critical. So, for example, if you have a 600 amp-hour battery bank at 48 volts, anything more than $600 \times 48 \times 10\% = 2880$ watts will quickly result in your system going into low voltage shutdown.

The above drives the maths needed to calculate the absolute smallest battery bank. We have seen designs that do not provide enough power to get through a single night or which would void the battery warranty or result in a service life of only a few years. By contrast and using lithium as an example, Sunergy designs for 5000 cycles and night-time consumption of 67.5% of the storage capacity whilst also ensuring the battery capacity meets the half hour maximum demand.

RELIABLE PRODUCTS WE TRUST

Power is an essential service. We therefore only use products that are tried and tested and have particularly good support. Here are the core brands we have been using for several years.



Selectronic manufacture the world's best off grid inverter charger, the SP Pro, right here in Australia. The Selectronic SP Pro has over ten years of proven robustness and reliability. Systems can scale up to 240kW 3 phase. Warranty is up to 10 years when installed with internet monitoring in place



Victron are a European company designing and manufacturing products for off grid applications from RV to large systems. Victron products are high quality and scalable. We typically recommend Victron for smaller systems such as RV, systems under 5kWh per day, or for larger systems where the budget does not stretch to Selectronic. Warranty on Victron is 5 years.



PowerPlus are an Australian company making awesome Lithium batteries right here in Melbourne. PowerPlus are different to almost all other lithium batteries in that they do not require a communications interface and have a wider operating temperature range. We have done some of the others and PowerPlus wins hands down for reliability, power delivery and customer support. Nothing is better than this battery.



Tesla Powerwall is available for use in off-grid applications.



Zenaji are Australian manufactured Lithium Titanate batteries. These promise a very large number of cycles (22,000) and come with a 20-year warranty. As with Powerplus, Zenaji have a wide operating temperature range and do not require a comms interface. We recommend Selectronic for Zenaji as other inverter brands may not be able to meet Zenaji's charge requirements.

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REC solar panels are manufactured in Singapore. REC panels are very high quality, have very low degradation over time and have high efficiency.



TINDO solar panels are made in Australia and have proven performance in Australian conditions.



WINAICO is made in Taiwan. Winaico panels are a fantastic blend of quality and price (also known as value for money). Winaico provides a complimentary 2-year insurance policy that covers the whole system against loss as a bonus.



CANADIAN SOLAR is our most budget friendly option without skimping on quality. Canadian Solar panels are manufactured in China.

All of our panel options:

- Have a 25-year product and 25-year performance warranty
- Have a direct Australian presence
- Are tier one as ranked by Bloomberg
- Have strong anti-slavery and anti-child labour policies and rigorously audit their supply chains for conflict materials

SITE REQUIREMENTS:

Solar arrays, battery banks, inverter/chargers and generators for off grid systems must be installed in locations that meet specific criteria. The distances between equipment, ventilation, security, infrastructure strength, equipment safety and vermin (particularly rodents and insects) can impact on your safety, system performance, reliability, and lifespan. Sunergy ensures that all our installations meet or exceed all applicable Australian standards and that your system is installed to achieve optimal safety, performance, and service life. During your site inspection/system consultation and design we look at existing facilities and provide you with recommendations about where the system components are to be installed.

Our contract with you provides clearly details on where equipment is to be installed, requirements before installation and what Sunergy and you are each responsible for.

Safety, Standards and Regulations: Sunergy takes safety, standards and regulations seriously. There are many standards and regulations specific to the design and installation of standalone power systems in Australia. This requires us to keep abreast of regulatory and other changes. In Victoria, all standalone systems are “Prescribed Work” and therefore require an independent assessment and inspection by Energy Safe Victoria.





What this means to you:

- Personal Safety - Stand Alone systems can be dangerous if not properly installed.
- Maximum system and component life is achieved.
- Confidence that your system abides by Australian Law.
- Your system meets regulations when inspected by an independent inspector .

Normal System Installation: It is usual to install inverters, regulators/charge controllers and batteries in sheds, garages, or utility rooms. If none of these are available, we can supply a cabinet to install your system into.

Typically, installation requires a clear, protected area of 2m x 1m (excluding generator). Requirements include:

- A strong fully framed construction.
- An outward opening door is required to meet Australian safety standards.
- As above, we can also supply cabinets to suit installations where a shed or garage is not available.

Solar Arrays: These should be located as close as practical to the standalone equipment; this is of particular importance for DC coupled installations. Tips for solar panel installation include:

- North facing while desirable is not critical. Excellent results can also be achieved with east/west splits.
- If your roof is less than 10° pitch, tilt frames are required to aid self-cleaning. We can work with any roof pitch, but shallower roofs may require more panels for winter performance.
- Avoid shading at all times of the year, this is especially critical in winter.
- Mounting solar panel on suitable existing roof structures eliminates the need for separate ground mount systems which are expensive.
- In most cases it is more economical to install more solar panels at a lower tilt angle to achieve a similar winter performance to higher tilt angles and/or for roof spaces which do not face true north.

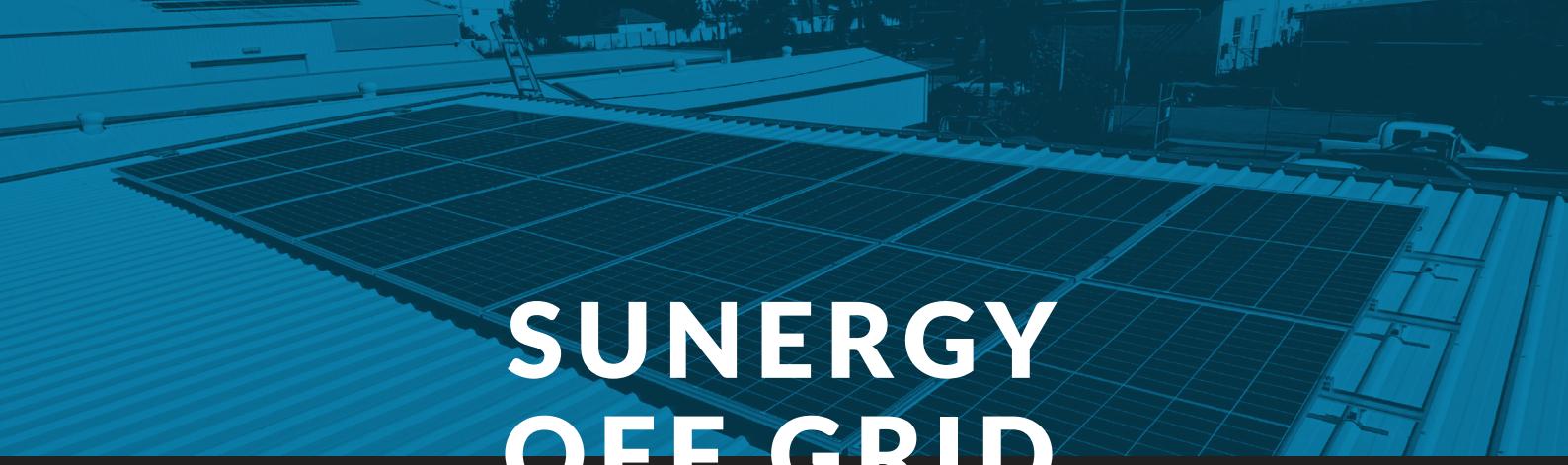
Generators: Please avoid yellow generators from eBay! Low priced generators typically have low quality alternators with aluminium windings. Your inverter/charger will have specific power quality requirements which if not met, will mean it won't connect to your generator. Please consult with Sunergy before making any generator purchase. If you purchase through Sunergy, we can guarantee it will work.

Sunergy strongly recommends auto start generators. These will take a lot of pressure off your battery bank and significantly extend its' life. All our systems have auto start functionality as standard and operate via a basic two wire start/stop mechanism.

Generators also require careful thought and planning when it comes to their installation and operation. The generator should be installed as close as is reasonably practical and convenient to the main residence and other standalone equipment while considering the possible noise level when in use. Please note different safety regulations are applicable to permanently installed generators and portable generators.

House wiring: For a conventional standalone power system installation there are no alterations or special considerations required for existing or new house wiring. Often house wiring and circuitry can be the same as any regular grid connected property depending on the intended plant specification. Existing wiring must however be compliant with electrical safety regulations. If the standalone system is installed in a separate shed, the electrical cabling between shed and (say) the home must be adequate for the household loads.





SUNERGY OFF GRID SYSTEMS ARE:



RELIABLE

Quality components provide grid quality power



EASY TO USE

Programmed to be fully automated and user friendly



LOW MAINTENANCE

Maintenance free batteries and reliable components



EFFICIENT

Highly efficient components



SAFE

Meets or exceeds applicable safety standards



MONITORING

System monitoring included

OPTIONS FOR HOT WATER



Hot water for off-grid homes traditionally has two options. Gas or solar with a gas booster. Some people use wetbacks on fireplaces, but no fire means boosting is still required.

Sunergy is not a fan of solar hot water due to maintenance and reliability issues. Flat plate systems fail in frosty conditions (unless they run antifreeze as a heat exchange medium). Evacuated tube systems are more frost-resistant, but flying sticks can break tubes during storms. Split systems (tank on the ground and the collector on the roof) are susceptible to dogs and parrots chewing sensor wires.

Increasingly people want to steer away from gas for environmental, safety and convenience reasons.

For people wanting gas-free hot water, Sunergy recommends modern heat pumps such as available from Reclaim, which uses CO2 as a refrigerant. Reclaim has the added advantage of integrating with your solar. Reclaim heat pumps remain efficient in cold weather (down to -10C). Reclaim heat pumps are similar in cost to gas boosted solar hot water.





WE HOPE YOU ENJOYED OUR OFF-GRID GUIDE!

If you are ready to start the conversation about off-grid living and want to get it right the first time please contact us today.

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