



The Ultimate Off-Grid Solar Guide

The essential research tool before you go off-grid

Embarking on the journey to adopt an off-grid solar system for your home requires careful consideration and understanding.

It is significantly more complex than installing a conventional grid-connected solar system. This guide aims to illuminate the crucial aspects to consider, outline the variety of off-grid systems available, and underscore the importance of a high quality off-grid inverter and batteries in building a dependable system.

Additionally, we'll explore the available batteries to identify which types best fit various needs to get a comfortable, independent and sustainable off-grid way of life.

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Why choose off-grid solar

Living off the grid has gained immense popularity in Australia as individuals seek greater freedom from traditional fossil fuel power sources. Sometimes there is also no choice as the cost of running powerlines to a remote property can be prohibitive. Key advantages include:

Grid unavailability or high connection costs - In many regional and rural areas, connecting to the grid can be expensive, with costs exceeding \$50,000. Additionally, some grid access cannot be obtained easily or quickly. Going off-grid becomes a practical and cost effective solution in such cases.



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When the traditional grid is down, an off-grid solar system owner still enjoys the comforts of an electrified home.

Environmental sustainability - Adopting an off-grid solar system contributes to a reduced carbon footprint. Solar power is a clean and renewable energy source that minimises environmental impact, helping individuals live more sustainably and contribute to the global effort to use less fossil fuels and combat climate change.

Protection against electricity price increases - Traditional grid-tied systems are susceptible to electricity price increases. We know electricity costs have increased above the rate of inflation for some years. Going off-grid shields homeowners from unpredictable grid power price increases and creates certainty.

Personal choice and philosophy - Beyond practical considerations, off-grid living often aligns with personal philosophies and lifestyle choices. Many individuals choose to disconnect from centralised power systems as a form of self-sufficiency and to live in more sustainably with the environment.

How do off-grid systems work?

Your options of power generation - Among the off-grid powering options of solar, wind and hydro, solar power stands out for its simplicity, reliability, and cost-effectiveness. The absence of moving parts, the decades of field tested equipment and relative low maintenance requirements make solar energy an attractive choice. Panels, inverter solutions and even batteries have reduced in price over the past decade.

Enough energy storage is vital - Reliable batteries are a major component in ensuring a consistent power supply, particularly during rainy and cloudy days or at night. Reliable battery chemistries include lithium and lead-acid (flooded, gel, and AGM), with lithium gaining popularity in newer off-grid installations due to its efficiency and reliability. For an in-depth exploration of battery chemistry contact us for further information.

Types of off-grid systems - Off-grid systems are categorized as either AC or DC-coupled, based on the scale of the setup. Smaller systems typically utilize DC-coupling with efficient MPPT solar charge controllers.





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Larger residential systems may use either type, depending on the specific off-grid inverter and compatibility with solar inverters or solar charge controllers. The most modern inverters can accommodate both AC and DC coupling, offering a versatile and secure energy solution.

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Misconceptions and realities

It's a common belief that assembling an off-grid solar system is straightforward. This may hold some truth for smaller setups like caravans or cabins.

However, larger systems, designed to energize homes and businesses, not only involve a substantial financial investment - often tens of thousands of dollars - but also demand meticulous planning and execution to avoid complications.

Expertise in considering factors such as current and future household energy requirements, peak demand, solar exposure, and potential system losses is paramount.

Make sure the size is right - It is also very important to size the solar and battery system appropriately. This is where experience and excellent off-grid design skills come into play. If you design the system too small, then you will rely on back up generators too often. If on the other hand you design the system overly generous, than you could be wasting money.

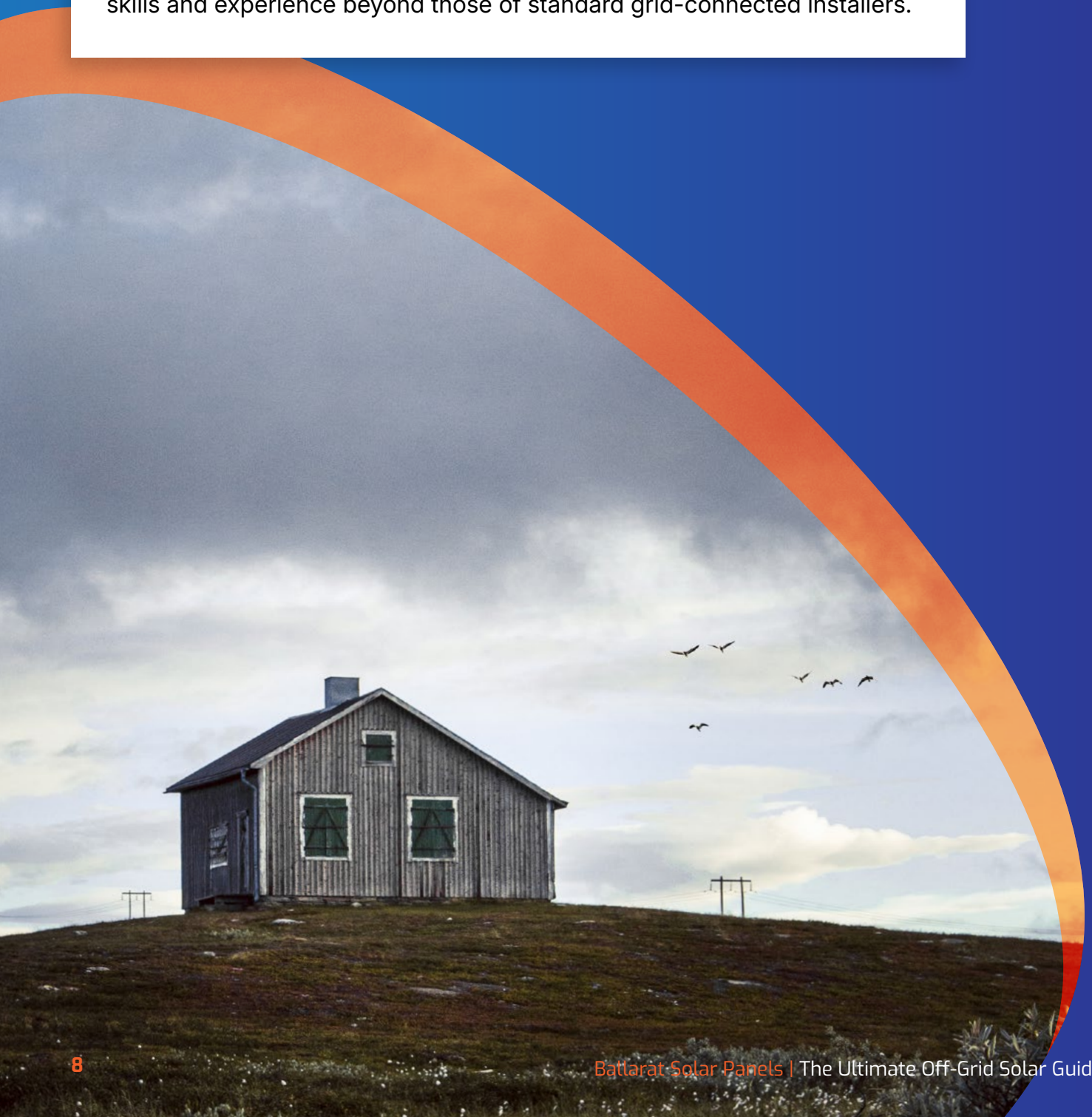
Therefore estimating all your likely loads all year round is the first step to getting a reliable solution.

Backup generation - Designing an off-grid system without a backup generator is technically feasible, but this approach has trade-offs that may not align with your preferences of reliability and comfort. Without a backup generator you simply might run out of battery in certain scenarios and your home will be without power until more solar power is created through the solar panel.



Economic considerations in cloudy regions - In areas with frequent cloudy weather, an excessively large solar and battery system is not cost-effective. Combining solar, battery, and a backup generator is a more cost effective and professional solution.

Matching consumption to resources - Your power and energy usage, plus the buildings location and potential shading are critical in designing a reliable off grid system. Our off-grid solar designers possess specialised skills and experience beyond those of standard grid-connected installers.





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Should I get an off-grid system?

Off-grid solar power offers a reliable and efficient way to generate electricity independently. The specific benefits are:

Self-sufficiency and reduced reliance on the grid - By generating your electricity, you become less dependent on the grid, increasing self-sufficiency and avoiding traditional electricity bills.

Feasibility in remote regions - The availability of grid connections does not limit off-grid solar. It is a practical solution for homes in remote areas, where grid connections are often less reliable.

Weather resilience - Contrary to concerns about power loss on rainy days, a well-sized off-grid system is designed to power your home regardless of weather conditions. A well designed system ensures continuous power supply.



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Considerations and cost estimates

Understanding your energy needs, considering scale, and factoring in equipment and installation costs are crucial steps in determining the viability of off-grid solar for your home.

The investment for a residential off-grid solar system can vary widely. A basic setup for essential electrical needs might range from \$15,000 to \$25,000, while more comprehensive systems for larger homes or businesses may cost between \$25,000 and \$50,000.

While there are now do-it-yourself off-grid solar system kits available, please consider that you will be with limited after sales support if you choose this option. The initial savings may evaporate quickly in later years, when off-grid specialists are required to fault find and fix a system that might not have been ideal from the start.

Energy usage and system size - Understanding your energy needs is critical. A rule of thumb suggests that a budget system delivering 10kWh/day with an even day/night split will start around low \$20k's.

Economies of scale - Larger systems benefit from economies of scale. For example, a 30kWh/day system with top quality gear would start at approximately \$75,000. These estimates exclude a backup generator and also depend on the Peak Power Capacity (how much power the system can release as a surge to cover start up surges for appliances like pumps), the remoteness of the location, the sophistication of the monitoring system, and the quality of the components.

Smaller system options - Smaller systems like Recreational Vehicle (RVs) systems can start from \$5,000, and would include essential components like an inverter, battery charger, outlets, and a Certificate of Electrical Safety. As all set ups can vary, we always recommend to contact us for a formal quote.

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When evaluating the suitability and efficiency of an off-grid solar system for your home, pay attention to several crucial factors:

Assessing energy needs - Start by examining projected energy consumption and usage habits. Look at your electricity usage in previous locations, consider the hot water system, cooking appliances, temperature control, and the number of household occupants. An experienced and professional designer will collate a list of these items and how many hours per day you expect them to be used, to ascertain your current and future energy use.

Understanding your energy needs ensures your chosen off-grid solar system meets your power and energy requirements.

System size determination - After understanding your energy needs, decide the right size for your system. Please collaborate with our expert staff about efficiencies that could be gained regarding your major appliances, or how insulation or modifications to the building would impact, the overall energy consumption.





Sunlight and panel placement - Assess sunlight availability, considering shading from structures or trees, and your area's climate. Our specialists will identify the best location, orientation, and tilt for solar panels to optimise efficiency. If your roof is small, consider a free-standing array.

Future-proofing - Think about your property's long-term plans, including potential expansions. Plan for a system that can handle future energy needs to avoid retrofitting costs. For example, oversizing the system can be beneficial if you plan to add an electric vehicle.

Days of autonomy - Design guidelines state that an off-grid system should include 3-5 days of battery autonomy during cloudy weather before the generator is called upon to support the system. However some allowance can be made to reduce battery size if there is room for expansion should the actual use exceed the estimates.

Each home is unique, so consult with our experts to assess your needs and find the best off-grid solar solution.

Generator choice - For many off-grid systems the choice of an automated generator ensures less negative experiences for system users, just keep it full of fuel and serviced regularly. Please note that electric start or remote start generators may not have an 'auto-start' function available so discuss this with your system designer.

Designing off-grid solar

Here's a step-by-step guide to understanding the process:

Step 1 - Load profile

In the initial phase, experienced and accredited off-grid designers collaborate with you to create a detailed load profile. This involves understanding your power needs by hour, day, and season.

The team ensures the system is designed to harness solar power for daytime needs while efficiently managing nighttime usage through battery storage. Heavy-use appliances may need to run directly on generator power, especially when budget constraints come into play. It is also important to purchase energy efficient appliances when considering an off-grid system.





Step 2 - Site assessment

For existing sites, on-site visits are conducted to determine equipment locations, shading factors, and roof sizes. Our designer works from site plans and aerial images for new builds or remote sites to gather the necessary information for the next steps.

Step 3 - Design

With a comprehensive understanding of your energy requirements and site details, specialised design software is utilised to create a detailed system design.

This includes determining the optimal solar, battery, and generator capacity for your power needs and budget. Our designer walks you through any necessary compromises, providing clear advice on trade-offs between cost and functionality.



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Step 4 - Pre-Installation Checks

Negotiate a suitable date and time so that you are available for both the beginning and end of installation, so we can discuss access to the site effectively and give you a 'handover' training session.

Ensure that you have the required generator on hand, and that it has been filled with oil, fuel and has a starter battery. Test it works or have your supplier test it before delivery.

"Your Off Grid Installer will be your friend for life"

Step 5 - Installation

Complete installation services are provided by us and carried out by accredited and qualified tradespeople. Depending on the complexity of the off-grid system it will take 1-3 days for the installation and hand-over. *Note - poor weather may delay your installation date.*

Step 6 - Service & monitoring

Beyond installation, we offer additional services including monitoring and remote support capabilities. These minimise call-out and travel costs. Ongoing system servicing and maintenance are also available to ensure continued optimal performance for many years to come.

Key benefits to living off-grid

- ✓ Understanding how to monitor and generating your energy needs
- ✓ Avoid the cost of upgrading local supply line grid infrastructure
- ✓ Environmental responsibility and an eco-friendly lifestyle
- ✓ Autonomy from grid blackouts
- ✓ Energy self-sufficiency
- ✓ Eliminating power bills

What to watch out for

Careful planning required - Off-grid living demands meticulous planning, considering energy needs and consumption patterns. Proper sizing of the solar system and ensuring sufficient battery storage for energy reserves during low sunlight are crucial factors for success.

Conscious energy usage - Adjusting to off-grid living involves a heightened awareness of energy usage. Lifestyle modifications, such as employing energy-efficient appliances, turning off lights when not in use, shifting energy use loads to the daytime, and reducing wasteful energy consumption become integral to a successful off-grid experience, without sacrificing comfort.

While off-grid living presents its challenges, the rewards are substantial. The autonomy, environmental benefits, and financial savings allows you to shape your energy future and positively impact the world around you.





Some off-grid system have panels that are over 20 years old

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Key components for off-grid success

Selecting the appropriate equipment and components for your off-grid solar system is essential to ensure optimal performance and long-term success. Given the multitude of options available in the market, making informed decisions that align with your specific needs and goals is crucial.

Solar panels - When it comes to solar panels, prioritise high-quality options from reputable manufacturers like REC and Jinko, which we offer as trusted brand products. Look for panels with high-performance ratings, low degradation rates, and extended warranty periods. A product warranty of no less than 25 years is recommended to safeguard your investment, ensuring that your solar panels operate efficiently over an extended period.

Inverter solutions - Choosing a reliable inverter is very important. The inverter converts the DC electricity from the batteries into usable AC electricity for your home. Opt for a high-quality, efficient, specific off-grid inverter such as Selectronic, Victron, Deye or Sigenergy that aligns with your solar panel system.

Battery storage - For off-grid solar systems, battery storage is critical for storing excess energy during the day for use at night. We offer trusted brands such as Power plus, Mitronix, WeCo, Pylontech and BAE.

Historically, lead-acid batteries were the go-to option for off-grid systems. However, in recent years, lithium-ion batteries have gained popularity for their higher efficiency, durability to heat, ability to rapidly charge, light weight, lifespan and scalability.





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Doing it right the first time

When considering off-grid solar systems, prioritising quality is fundamental, regardless of the specific provider. Ensuring the proper system sizing and selection of equipment and components plays a pivotal role in the performance, durability, and longevity of your off-grid solar system.

Investing in high-quality components may entail a higher initial cost, but the long-term benefits far outweigh the upfront expenses. Quality components contribute to:

- ✓ Optimal performance and efficiency
- ✓ Ongoing comfort and no surprises
- ✓ Durability and longevity



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Safety and reliability are non-negotiable

Off-grid solar systems involve the storage and distribution of electricity, making safety a critical consideration. You are now managing your own power station. Therefore quality components from reputable manufacturers are a must. They will lead to higher safety standards and stronger reliability.

Warranty protection and peace of mind

Opting for quality components often comes with additional warranty protection, providing peace of mind for your investment. Key points to consider when picking the components include:

- **Longer warranties**

Reputable manufacturers offer longer warranties, showcasing confidence in the quality and durability of their products.

- **Strong coverage for malfunctions or defects**

A reliable warranty ensures coverage for necessary repairs or replacements in the event of a malfunction or defect.

Addressing concerns about upgradability is crucial for those planning to expand or modify their off-grid solar systems over time. Key considerations include:

Plan for upgradability from the beginning

It's advisable to plan an upgradeable system from the outset rather than attempt to upgrade later.

Considerations for battery banks

Lead acid battery banks can pose challenges for upgrades, while lithium systems are generally more adaptable.

Preferred brands and compatibility

Off-grid systems using preferred brands often come with upgradability options, ensuring compatibility with future models.

In summary, cutting corners on quality can compromise your off-grid solar system's long-term viability and effectiveness. Whether starting small, or planning for future expansions, investing in quality components and working with reputable manufacturers ensures that your system operates at its full potential. Don't compromise on quality—it's an investment worth making for your family or business.





Ballarat Solar Panels follows all the important guidance given in this guide.

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