

STAND-ALONE POWER SYSTEMS

A PRACTICAL GUIDE

AT A GLANCE

Best suited to:

Businesses in remote locations or with frequent outages

Main benefit:

Improved energy reliability

Main barriers:

Need for proper system design and sizing

Good first step:

Understanding your current usage and the risks of supply failures

Image: Essential Energy





OVERVIEW

Stand-alone power systems (SAPS) are independent electricity systems that operate without a permanent connection to the main electricity grid. A normal solar-battery system still relies on the grid most of the time and may only provide limited backup during outages. SAPS, on the other hand, typically combine solar panels, batteries, inverters, backup generators and smart controls to manage supply and demand to provide reliable power without access to the grid.

SAPS can range in size – from a small system powering a remote pump, to larger systems that power small communities of homes and businesses. SAPS are designed to operate independently every day of the year, including through extended poor weather, seasonal load changes and peak demand periods.

SAPS can be built, owned and operated by individual businesses, or by the local Distribution Network Service Provider (DNSP). Where a DNSP is driving the use of a SAPS, the DNSP would disconnect the customer from the grid and build the solar, battery, and diesel generator backup. The business would still pay electricity bills based on usage, and would not own the asset. Business initiated off-grid systems require the business owner to pay for the SAPS themselves, including their maintenance and operation, but there are no further network charges.



SUITABLE BUSINESS TYPES

For many rural and regional businesses, SAPS are becoming a practical option where power supply is unreliable, long power lines are expensive to maintain or upgrade, or where remote infrastructure needs energy in isolated locations. This might include:

- Remote and/or already off-grid properties, or businesses with remote facilities such as houses or workers' accommodation, sheds, workshops, packing facilities, or tourism operations.
- Cold rooms or small processing operations.
- Telecommunications and monitoring equipment.

- Businesses with frequent outages or poor voltage quality.
- Businesses using bore pumps and water transfer systems or farms with irrigation automation and telemetry.



BENEFITS

There are a number of potential benefits from SAPS, including:

- Improved energy reliability, with reduced outages and voltage problems.
- Greater control of the business' energy supply.
- Reduced long-term energy costs (in some cases) with no network charges.
- Supports electrification by enabling transition away from diesel and gas, and allows the integration of electric pumps, electric heating, and electric vehicles (EVs).
- Avoids network upgrade costs (particularly relevant where connection upgrades are expensive and the network is at capacity).
- Environmental benefits with lower emissions.



CHALLENGES

Some of the challenges to consider include:

- Upfront capital costs and battery replacement costs over time. Some DNSPs may contribute to capital costs, in recognition that the DNSP can cease to maintain network assets once disconnected.
- Need for proper system design and sizing to ensure power is available when required. SAPS need to take account of the potential for future electrification, including adding EVs, electric heating and cooling, or electric irrigation.
- Large or unpredictable loads can be more difficult to manage.
- Limited availability of experienced installers in some regional areas.
- Ongoing management of operation and maintenance, including generator maintenance and fuel logistics.



TECHNICAL CONSIDERATIONS

Understanding energy use

The success of a SAPS depends heavily on understanding how electricity is used across the day and year. Key considerations include:

- Pump loads and motor starting currents.
- Peak and seasonal demand.
- Refrigeration or cold room operation.
- Workshop or machinery loads.
- Future electrification plans such as EVs or electric machinery.

SAPS have finite generation and storage capacity. Large simultaneous loads can overwhelm under-sized systems.

Battery storage and backup generation

- Batteries provide overnight operation and support during longer periods of poor generation conditions. Battery sizing is critical. If the system is too small, it increases the risk of an outage or generator overuse. If it is too large, it can result in unnecessary capital cost.
- Many SAPS also include a diesel generator for resilience during extended wet weather, high-demand periods, or to ensure energy is available during equipment failures or maintenance. Well-designed systems minimise generator runtime while ensuring reliability.

Smart controls and load management

Modern SAPS increasingly use:

- Demand management controls, including automatic load shedding.
- Remote scheduling and monitoring.
- Generator auto-start.

This can significantly improve reliability and reduce fuel consumption. Optimising system use might also include:

- Prioritisation of essential loads (such as stock watering).
- Ability to shed or delay non-essential loads.
- Scheduling of high-energy activities.



IMPLEMENTATION CONSIDERATIONS

Land or space considerations

The size of the system needed will determine the land or roof space required for solar arrays, batteries (which are typically containerised or shed-mounted), and a generator for the backup power.

Skills or training required

Successfully running a SAPS requires a basic understanding of energy use and system operation. Installer training is usually provided, and appropriate monitoring systems will assist with maximising efficient operation.

Suppliers or service providers

- It is important to plan and install your SAPS system using specialist off-grid system designers, and solar and battery installers with SAPS experience.
- Access to electrical contractors and generator suppliers is needed.



DECISION FACTORS

When this option may make sense

- A site has frequent outages or poor reliability.
- There is a high cost to connect, upgrade, or maintain grid connection.
- You are willing to actively manage energy use.
- You have a new site that is distant from a power line, or you have an existing site on an unreliable power line and want to expand operations.

When it may not be suitable

- Reliable, low-cost grid connection.
- High and inflexible energy demand.
- Limited communications or individual capacity to manage the system.
- Short-term property ownership or leasing.

Key decision criteria

Some factors to consider when deciding whether SAPS are right for you:

- The cost of staying connected versus going off-grid (including access to capital and any financial assistance available).
- The risks of lack of supply once disconnected.
- Whether the system can be managed to shift or manage loads to match generation, or to prioritise loads in low energy demand periods.
- Costs depend heavily on load size, reliability requirements, and the level of backup needed. SAPS for small homestead systems could cost around \$20,000 – \$80,000, while larger or high-demand systems could cost \$250,000 – \$1,000,000.

**CASE STUDY.****STAND-ALONE POWER
IN THE SNOWY MONARO**

Essential Energy is working with customers located at the end of remote powerlines to ensure reliable and safe electricity supply through the provision of stand-alone power systems. Systems include solar panels, a battery for energy storage, and a backup diesel generator. Systems have built-in redundancy to minimise outages.

One property in the remote alpine Snowy Monaro region of New South Wales has seen improved reliability while also providing improved network resilience and cost efficiencies for the company. An additional benefit for both parties was minimising the number of contractors required to attend the property for vegetation management.

Essential Energy customer Greg said: “It is off grid, but it’s an ‘off grid’ provided by the people that provide the grid... It’s the logical way to go for remote properties.”

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For more information see: www.essentialenergy.com.au/our-network/stand-alone-power-systems



www.re-alliance.org.au/electrification