

MICROGRIDS

A PRACTICAL GUIDE

AT A GLANCE

Best suited to:

Remote businesses or those in a shared retail precinct

Main benefit:

Improved reliability and lower costs

Main barriers:

High upfront costs and challenging regulatory frameworks

Good first step:

Testing interest with other local businesses

Image: AGL





OVERVIEW

A microgrid is a local, small-scale power grid of interconnected loads and distributed energy resources that can operate either independently or connected to the main electricity grid.

Microgrids typically consist of:

- Energy generation resources such as wind or solar.
- Battery energy storage with islanding capability (i.e. the ability to operate independently of the grid) during outages, and possibly with diesel or gas backup.
- Microgrid control systems that have priority load management and more generally balance loads and control to the grid.

While still at an early stage of deployment in Australia, microgrids are increasingly seen as a potential solution to increasing electricity costs, grid outages, and energy insecurity, and demands for increased community or private ownership of electricity assets.



SUITABLE BUSINESS TYPES

Microgrids tend to succeed where there is single ownership or strong central control, multiple loads behind one meter (embedded network), high or critical energy demand, a priority put on reliable energy supply (not just cheaper power), and a physical proximity of loads (campus or precinct layout). The type of businesses that may benefit include:

- Commercial and retail precincts (e.g. shopping centres, business parks, campuses) with single ownership or coordinated management, multiple tenants behind one connection, high daytime energy demand, and centralised Heating, Ventilation, and Air Conditioning (HVAC), lighting or refrigeration loads.
- Remote communities and townships struggling with energy security and reliability, or those that are susceptible to natural disasters, or have high grid connection costs.

- Healthcare facilities (hospitals, nursing homes, aged care). Because healthcare facilities must maintain uninterrupted power, they will already have backup generators for use during power outages, supporting their integration into a microgrid. Healthcare facilities also have 24/7 energy demand and often have single ownership.
- Intensive operations requiring high energy demand and continuous use such as piggeries (ventilation, heating, waste systems), poultry farms (lighting, climate control), or dairy farms (milking equipment, refrigeration).
- Cropping farms with irrigation systems (pumps), shared water scheme participants, or grain drying and storage facilities.



BENEFITS

There are a number of potential benefits to developing microgrids. These include:

- Reduced electricity costs over time (especially with solar).
- Improved reliability (less outage risk from blackouts or bushfires).
- Energy independence, particularly in remote areas.
- Lower exposure to rising energy prices.
- Lower emissions.
- Potential income from exporting excess energy (where allowed).
- Community or private ownership.



CHALLENGES

Some of the challenges to consider include:

- High upfront capital cost and battery replacement costs over time.
- System complexity, including governance and the need for participants to collaborate on system protocols such as design, network integration, and maintenance. There is currently a lack of standards, a lack of templates for ownership models, and unclear rules around energy sharing.

- Safety and reliability obligations of the microgrid most commonly require Distribution Network Service Providers (DNSPs) to maintain poles and wires, creating complex relationships and untested service agreements.
- Requires careful sizing to avoid under or over-investment.
- Regulatory, grid connection approvals, licensing and retail regulations can be complex.
- Technical complexity requires specialist support.
- An inability to share solar power across titles on the same property in most jurisdictions.



TECHNICAL CONSIDERATIONS

Infrastructure requirements

Systems will usually require:

- Renewable generation, usually solar PV.
- Energy storage such as lithium-ion batteries.
- Suitable metering and control systems.
- Energy management systems for balancing supply and demand.
- Distribution systems including local wiring, switchboards, smart meters, and switching equipment to disconnect at various times.
- Backup generation, often diesel or gas generators or grid connection (for reliability).

Grid connectivity

- Grid-connected (hybrid) systems can import/export power and provide backup and flexibility.
- Off-grid systems are fully independent but require robust storage and control systems and backup options (diesel generator, gas, or battery).
- Islanded capability is able to disconnect from the grid during outages and run independently for as long as they are able to draw on battery storage or generator capacity.



IMPLEMENTATION CONSIDERATIONS

Land or space requirements

- Rooftop solar systems typically require around 4–5 m² per kilowatt (kW) installed. Ground mounting will typically require 2–3 hectares per megawatt (MW) – though it may be possible to continue commercial activities under the panels.
- Batteries (which are typically containerised or shed-mounted) and control systems.
- Space for new grid infrastructure if needed.

Skills and training required

- Specialised knowledge in power system operations, controllers, and renewables integration is required for microgrid establishment. The design for ‘islandable’ systems would require 2–3 days of backup battery storage capacity and smart controls for frequency/voltage management.
- Regulatory and compliance considerations such as ‘exempt seller’ and ‘network exemption’ guidelines and compliance with local DNSP.
- Established protocols so all microgrid participants understand the loads that may be shed during low power conditions.



DECISION FACTORS

When this option may make sense

- You have high or rising electricity costs.
- There is a community keen to collaborate on a shared energy solution.
- There is load diversity across participants.
- You experience frequent power outages or unreliable grid supply.
- Your location is remote and/or grid connection is expensive.
- There is consistent daytime energy demand (good for solar use).
- You have a long-term ownership horizon (to recover upfront investment).

When it may not be suitable

- You have very low energy usage (limited return on investment).
- Community members are not willing to collaborate on energy initiatives.
- Reliable, low-cost grid electricity is already available.
- You have limited capital or financing options.
- Your business plans are short-term, or you urgently need to save on energy costs.
- There is no regional expertise to assist with set up and maintenance.

Key decision criteria

Some factors to consider when deciding whether a microgrid is right for you:

- The payback period and return on investment (ROI).
- Your energy demand profile (timing and consistency).
- Membership of the microgrid and the ability to obtain agreement on costs, use of power, etc.
- Reliability requirements (critical versus flexible loads).
- Responsibility for maintenance and operational complexity.

**CASE STUDY.****CADELL ORCHARDS MICROGRID**

Cadell Orchards is a 1,690-hectare almond orchard in a remote part of New South Wales that is not connected to the electricity grid. Because connecting the property to the grid was prohibitively expensive, the orchard relied on diesel generators to power its irrigation system.

Working with the orchard's operator, Australian Farming Services, AGL installed an on-site microgrid comprising a 4.9 MW tracking solar array, 5.4 MWh battery, approximately eight kilometres of underground powerlines, and smart control and communication systems. The microgrid generates, stores and distributes electricity across the property, substantially reducing – but not eliminating – its reliance on diesel generation.

The system supplies up to 6.1 GWh of renewable electricity annually and is expected to avoid 4,340 tonnes of carbon emissions each year. AGL owns, operates and maintains the microgrid under a 20-year power purchase agreement, allowing Cadell Orchards to access renewable energy without upfront investment.

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For more information: agl.com.au/business/sustainability/industry-projects/cadell-orchards



www.re-alliance.org.au/electrification