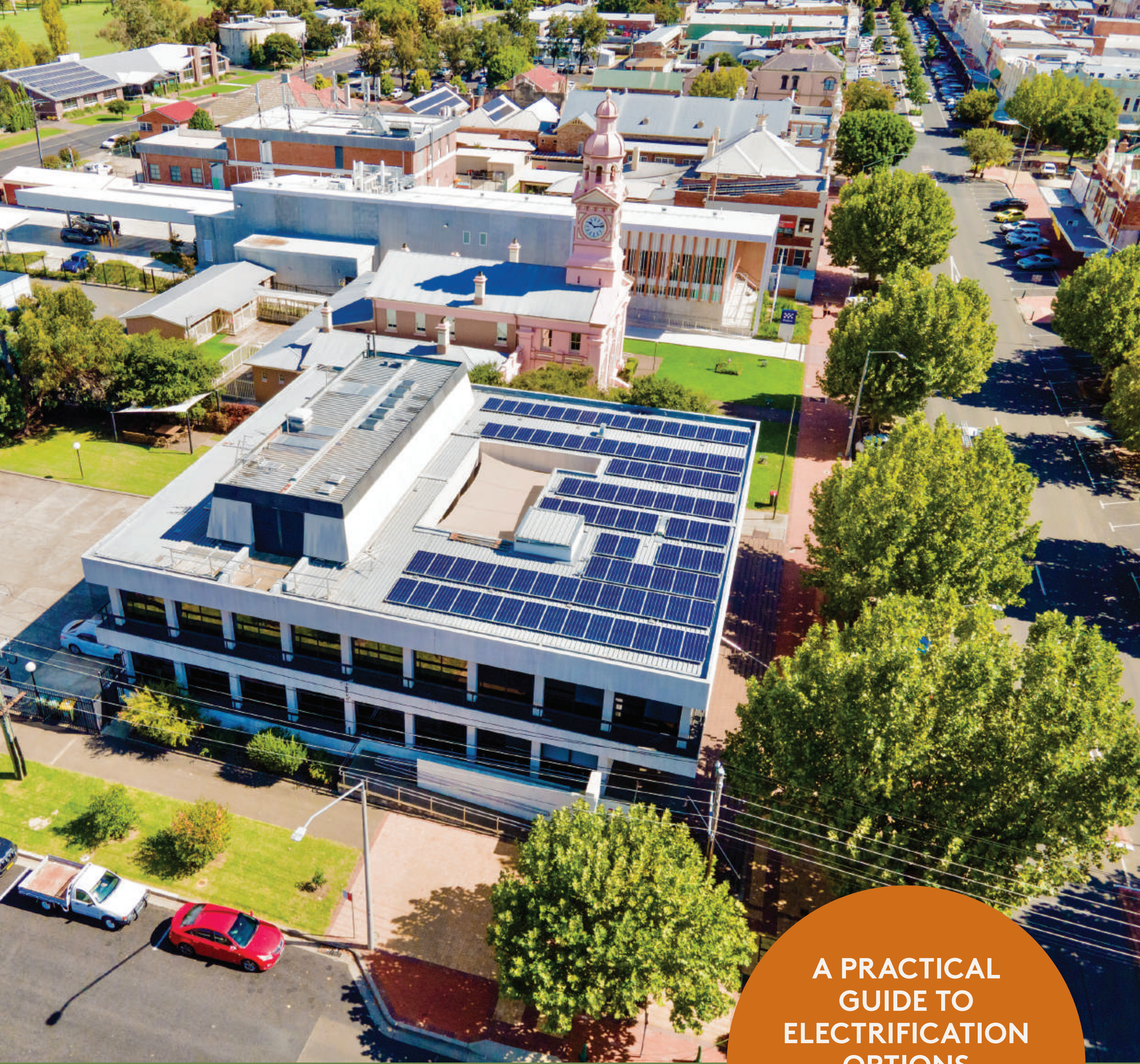

A PRACTICAL GUIDE TO ELECTRIFICATION OPTIONS FOR REGIONAL AND RURAL BUSINESSES

ELECTRIFYING REGIONAL AUSTRALIA

RE-ALLIANCE

farmers for climate action

Acknowledgement of Country

RE-Alliance and Farmers for Climate Action pay respect to First Nations peoples and their Elders past and present, who, for thousands of generations, have cared for Country and sustained the world's oldest living culture. We acknowledge sovereignty was never ceded. We commit to working alongside First Nations peoples to achieve a just energy shift.

Acknowledgements

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Disclaimer

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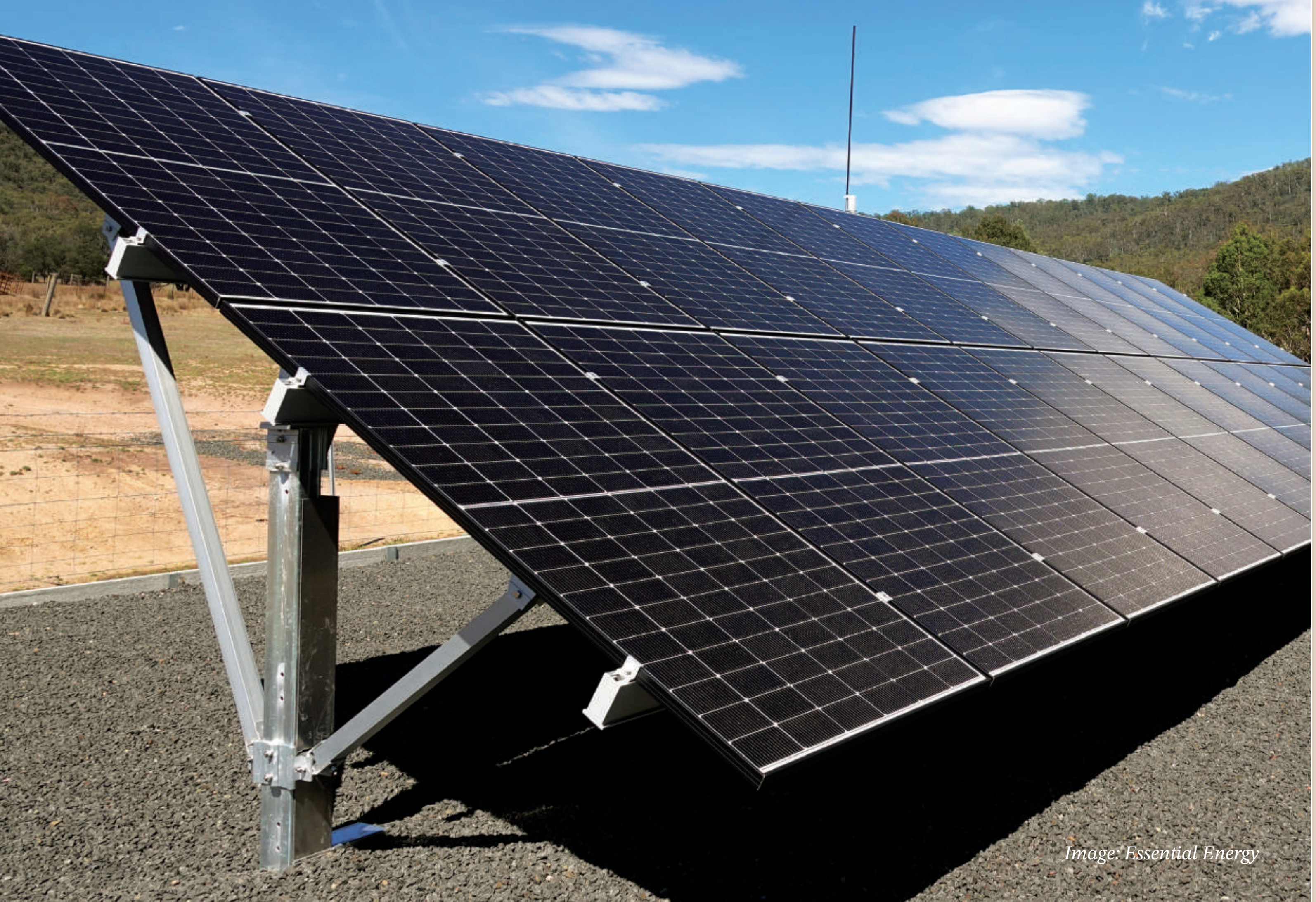


Image: Essential Energy

CONTENTS

ABOUT RE-ALLIANCE

The Renewable Energy Alliance, or RE-Alliance, is working to deliver a responsible shift to renewable energy that actively contributes to the strength of our regions.

We listen to and build the capacity of rural and regional Australians to lead the shift to renewables in their communities. We elevate stories that show how people in renewable energy regions are ensuring projects deliver local benefits. And we work tirelessly to ensure that rural and regional voices are at the centre of our advocacy with governments and industry.

ABOUT FARMERS FOR CLIMATE ACTION

Farmers for Climate Action represents 8,400 farmers and more than 80,000 community supporters across Australia. We organise and amplify farmer leadership at a national scale — across commodities, regions and political divides — to influence the decisions that shape agriculture's future. By combining community organising, credible evidence and narrative leadership, we drive practical climate solutions that strengthen farm profitability, restore landscapes and build resilient rural communities.

INTRO

Regional households and businesses across Australia are being squeezed by rising power bills, diesel price volatility, unreliable energy supply and pressure to cut emissions.

At the same time, energy systems are changing. Households, businesses and farmers now have more ways to manage their own energy use, and generate, store or share power locally.

Electrification – swapping diesel, gas and other non-electric fuel-powered equipment and machinery for electric alternatives – gives farmers and businesses more control over their energy costs and supply. Electrification with renewable energy also supports efforts to cut carbon emissions – something customers are increasingly asking for.

Electrification will not be right for every business immediately. But for many farms and small businesses it can offer more independence, lower running costs and greater resilience.

> This report has been prepared to help rural and regional small businesses and farms think about the electrification options that might be right for them.

It doesn't answer every question a business owner may have, but it is a good introduction to the most commonly available options, and a first step in working out what might be right for you.

ELECTRIFICATION OPPORTUNITIES

The range of readily available technologies in this report includes solar, energy storage, stand-alone power systems, and electric machinery and vehicles. Emerging technologies and market structures are also outlined, including community batteries, virtual power plants (VPPs), and microgrids. These options give businesses more ways to generate and share power, benefiting both their own operations and the wider regional energy network.

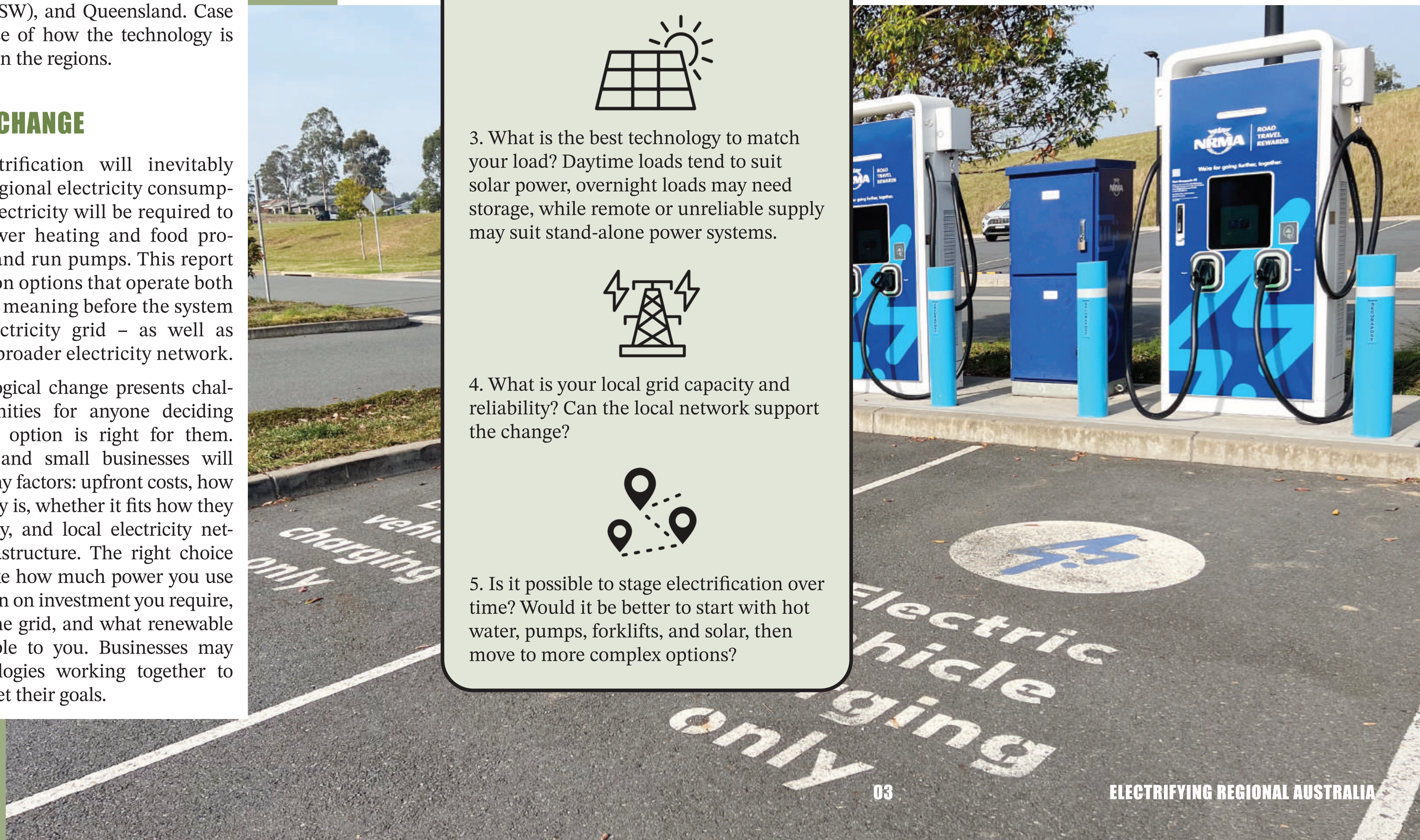
Every rural and regional business is different, so the right electrification option for one may not be the right one for another. For example, town-based businesses and households are more likely to face space constraints and may have consistent year-round energy profiles, while farm businesses may be more likely to have seasonal demand and more available land to implement different options.

Information on the different technologies has been developed based on existing research, supported by interviews with 11 farming businesses in Victoria, New South Wales (NSW), and Queensland. Case studies give a glimpse of how the technology is currently being used in the regions.

IMPLEMENTING CHANGE

The move to electrification will inevitably increase rural and regional electricity consumption, as additional electricity will be required to charge vehicles, power heating and food processing equipment, and run pumps. This report outlines electrification options that operate both 'behind-the-meter' – meaning before the system connects to the electricity grid – as well as options that use the broader electricity network.

The pace of technological change presents challenges and opportunities for anyone deciding which electrification option is right for them. Households, farms, and small businesses will have to weigh up many factors: upfront costs, how mature the technology is, whether it fits how they use energy day-to-day, and local electricity network rules and infrastructure. The right choice depends on things like how much power you use and when, what return on investment you require, your connection to the grid, and what renewable resources are available to you. Businesses may need several technologies working together to fully electrify and meet their goals.



Finding the right solution for you starts with understanding your energy use, then matching that to the right technology for your budget. As you review the options outlined in this report, we recommend keeping some key questions in mind:

1. What do your fuel and energy bills look like? What costs the most: electricity, diesel, LPG, gas?

2. What opportunities are there for improving efficiency? Can consumption and demand be reduced before adding new equipment?

3. What is the best technology to match your load? Daytime loads tend to suit solar power, overnight loads may need storage, while remote or unreliable supply may suit stand-alone power systems.

4. What is your local grid capacity and reliability? Can the local network support the change?

5. Is it possible to stage electrification over time? Would it be better to start with hot water, pumps, forklifts, and solar, then move to more complex options?

Always get independent advice on your specific needs before embarking on a major capital spend.

REACHING ELECTRIFICATION

A significant amount of Australia's on-farm and regional energy consumption takes the form of liquid fuels, primarily diesel. In the short term, other technologies may be needed to support the long-term shift towards electrification. A recent report by Farmers for Climate Action explores this in more detail: **Energy Sovereignty for Regional Australia: Protecting Farmers, Powering the Future.**

YOUR NEXT STEPS

This report gives small rural and regional businesses and farmers a practical introduction to the electrification options available, along with the key things to consider when working out what's likely to work best for your situation. We hope it helps you take the next step on your electrification journey.

SOLAR PV

AT A GLANCE

Best suited to:
Any business with sufficient roof or ground area

Main benefit:
Lower fuel and grid electricity costs, and reduced exposure to price swings

Main barriers:
Payback period depends on your tariffs and usage

Good first step:
Understand your current and projected future energy use to inform system design

Image: Scion Wine

OVERVIEW

Solar photovoltaic (PV) systems convert sunlight into electricity, converted into a useable form by an on-site inverter. Solar systems can be grid-connected, hybrid (meaning both grid-connected and fitted with batteries), or fully off-grid, depending on location and need.

Because energy generation is directly linked to solar output, businesses wanting to match energy production and use may need to install a battery system to increase self-consumption and energy resilience. Energy management systems and monitoring software can help make the most of the energy generated.

Solar panels can be installed alongside commercial enterprises either on roof tops, on ground-mounted structures, or on unused land. In agricultural settings, farming can continue under larger solar systems – this is known as 'agrivoltaics'. It can include the grazing of sheep or cattle, or the growing of certain crops (e.g. leafy greens, berries, some fruit trees, and vineyards).

SUITABLE BUSINESS TYPES

Rural and regional homes and businesses are ideal candidates for solar, typically installed on roof tops. The priority should be to size the system to maximise self-consumption while considering future power needs, such as electric vehicles. Adding a battery can enable the use of the energy at all times of the day and, when supported by an aggregating service, can support the selling of excess energy to produce additional income – particularly when energy can be exported during peak network demand periods.

Businesses that may particularly benefit from solar installation include:

- Mixed businesses where rooftop solar can offset general electricity use (e.g. workshops, refrigeration, water systems).
- Intensive farming operations (e.g. piggeries, poultry, dairies) with high and consistent daytime energy demand. Dairies will often require storage as their peak energy demand (e.g. milking) doesn't align with peak solar generation.
- Irrigated cropping farms where there is a strong match between pumping requirements and daylight hours.
- Businesses operating out of or supporting remote homesteads, water pumping, or other infrastructure.

BENEFITS

There are a number of potential benefits in adding solar to business operations:

- Reduces electricity/diesel costs and exposure to price volatility.
- Works well with daytime business loads (especially cooling or irrigation).
- Low operating and maintenance costs once installed.
- Long lifespan of panels, typically 20–30 years.
- Can improve energy independence and resilience (especially with batteries).
- Reduces greenhouse gas emissions (financial incentives may be available to support this).
- Potential additional income from exporting excess energy (depending on network constraints and the local energy retailer).

CHALLENGES

Some of the challenges to consider include:

- Potential high upfront capital investment, especially if batteries are included.
- Solar output varies with weather and seasons. Systems need to be carefully designed to match energy needs over the long term.
- Energy export constraints and decreasing feed-in-tariffs can limit financial returns from any energy export.
- Dust and dirt can build up on panels in some environments, so maintenance may be required.
- Payback periods vary depending on usage patterns and tariffs, with the highest returns on systems that have high utilisation.

TECHNICAL CONSIDERATIONS

Efficiency considerations

Using energy as efficiently as possible will reduce the number of solar panels needed. Considerations for improving efficiency include:

- Implementing appropriate energy efficiency measures before deciding on the size of the solar system required.
- Aligning work-load profile with maximum solar generation (e.g. daytime versus nighttime demand).
- Integrating solar production with other electrified equipment such as appliances with variable speed drives or electric boilers to maximise use.

Grid connectivity

Solar systems that are not entirely off-grid need to integrate with the local network, which may impose some limitations on use. Things to consider include:

- Network constraints or grid export limits in the area that may be imposed by network service providers.
- What feed-in tariffs, if any, are available for exported solar.
- The best system size for your property, taking into account your self-consumption versus export opportunity, and the costs of grid connection.
- Any planning approvals required, particularly for large ground-mounted systems.

IMPLEMENTATION CONSIDERATIONS

Land or space considerations

The location of solar panels is important, with key considerations including:

- Ensuring sufficient, structurally suitable roof space or ground area is available. Rooftop solar systems typically require around 4–5m^2 per kilowatt (kW) installed. Ground mounting will typically require 2–3 hectares per megawatt (MW), noting it may be possible to continue commercial activities under the panels.
- Panel orientation. North-facing with minimal shading preferred, but east and west facing panels can change the generation profile to match energy needs.
- Panel exposure to dust, extreme heat, or livestock, which could require extra maintenance or cleaning, and could affect durability.

Suppliers or service providers

- Solar systems should be designed by accredited designers and installed by accredited professionals – for example, those certified through **Solar Accreditation Australia**.
- Appropriate solar equipment suppliers (panels, inverters, batteries) and electrical contractors will be needed, particularly if you are trying to maximise integration with other business systems.
- Energy consultants for system design and cost-benefit analysis can be an important resource. Farming businesses should seek consultants who also have experience with agriculture.
- It is important to know who your local energy utility or retailer is, so you can understand any grid connection restraints, as well as the tariffs available to you – including feed-in (export) tariffs.

Power interruptions

- A standard grid-connected solar system will automatically shut off during a power outage. This is needed for safety reasons, so the solar system doesn't send electricity back into the grid while crews are working on power lines. Islanding capability (i.e. allowing the system to disconnect from the grid and operate as a stand-alone system) is therefore important where power interruptions must be avoided. To enable this, a battery system (with a suitably designed inverter) can be installed to provide the storage, stable voltage, and frequency needed for the solar system to keep running.

DECISION FACTORS

When this option may make sense

If the primary driver for installing solar is to achieve a good return on investment or have the system pay back over time, under current feed-in tariffs, the system should be designed to utilise as much of the energy on-site as possible to minimise costs. The more electricity that is exported by a system at a low feed-in-tariff rate, the longer the payback period will be.

Solar is particularly suited to:

- High daytime electricity use (e.g. irrigation, cooling, processing) or flexible loads (e.g. pumping) to make the most of the solar hours during the day.
- High grid electricity prices.
- Suitable roof or land space available where panels can be co-located with other activities.
- Reliable grid access (for grid-connected systems).
- Businesses that want to generate their own energy in circumstances where grid connection is not viable.

When it may not be suitable

Factors that may reduce the effectiveness of a solar system include:

- Land constraints (shading, poor orientation, no option for agrivoltaics).
- Short-term building occupation or land use uncertainty (e.g. lease arrangements).
- Significant grid export constraints with low self-consumption.
- Very low or highly seasonal electricity demand such as seasonal irrigators using high power pumps that are only used for a small number of days per year, particularly if electricity is not able to be exported to the grid or used elsewhere.

Key decision criteria

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

- Future energy use (can the system be scaled, can a battery be added, will it support switching diesel to electric?).
- Whether the energy load profile matches, or could be made to match, solar generation.
- System size and self-consumption versus energy export potential (e.g. are export and feed-in-tariffs worth the larger system size).
- Grid connection constraints, any network limits on export, and any requirement for grid augmentation (transformer or network).
- Reliability needs (grid versus hybrid versus off-grid).
- Quality and reputation of suppliers/installers.
- Capital cost and expected payback period. System cost depends on size, panel brand, installation complexity (steep roof or difficult access), and any required extras. A simple rule of thumb: budget ~$1,000 per kW installed for reasonable quality. Financial incentives may be available.

CASE STUDY.

SCION WINE

Scion Wine in Rutherglen, Victoria, has combined renewable energy with broader sustainability practices across its vineyard, winery, and cellar door operations. Scion has installed a 32 kW 3-phase solar photovoltaic system and used battery storage to help manage the higher-demand load from winemaking equipment. Government rebates significantly offset the solar system's upfront cost.

A solar-powered Tesla charging station is also available on-site for cellar door customers, which owner and winemaker Rowly Milhinch says demonstrates to customers their commitment to clean energy solutions.

To support broader sustainability efforts, Scion also undertakes biological management of the soil ecosystems, uses rainwater to run the winery and cellar door, hosts eight beehives in a dedicated area, and has invested in biodiversity enhancement, so it is now surrounded by 1,200 native trees.

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For more information: sustainablewinegrowing.com.au/case-studies/biodiversity-and-renewable-energy-scion/

ENERGY STORAGE

AT A GLANCE

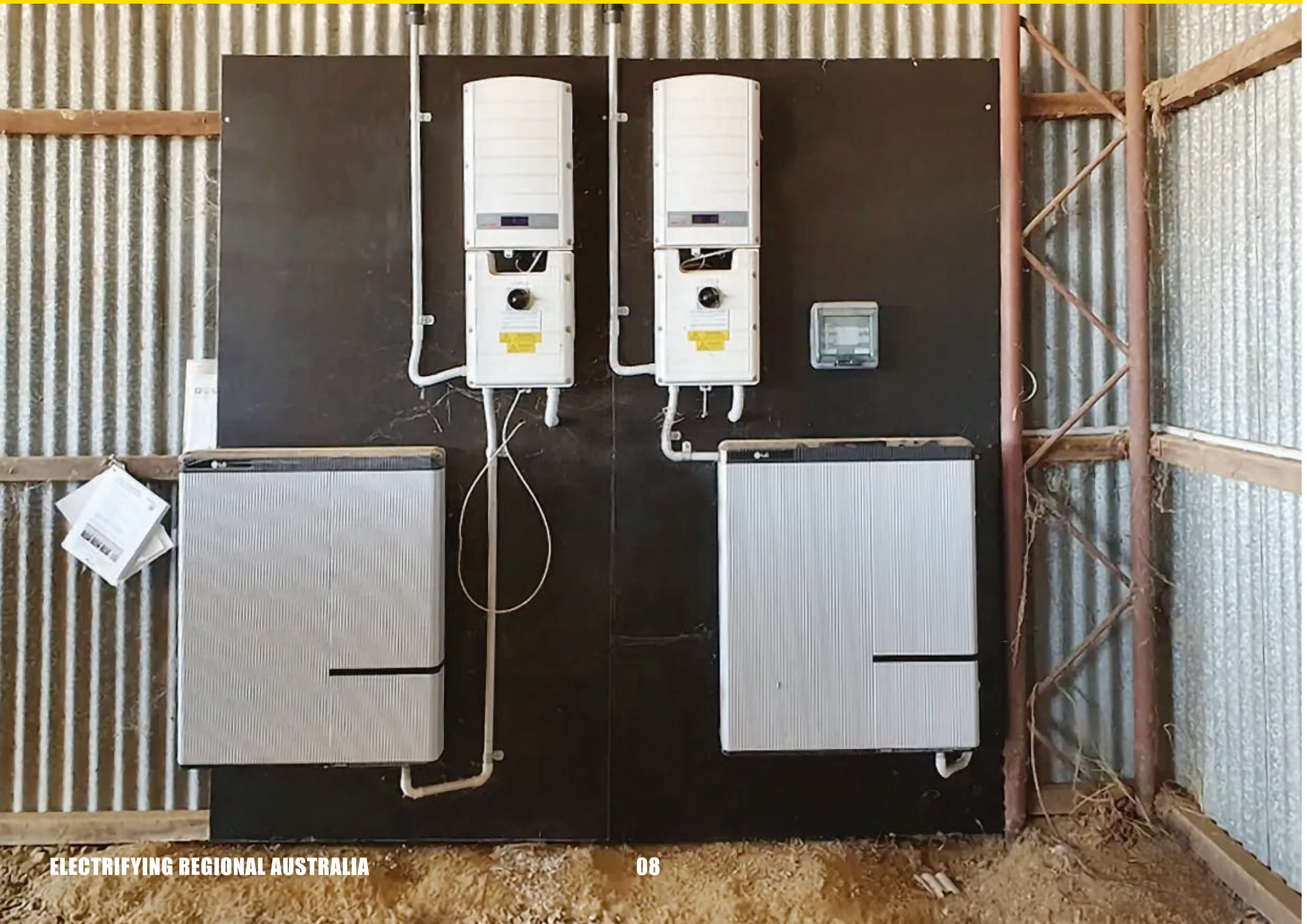
Best suited to:
Businesses with high energy use or a need for reliability in an unreliable system

Main benefit:
Supports better use of existing renewable energy production

Main barriers:
Your upfront costs and payback period depend on tariffs and usage

Good first step:
Understanding how storage will work with your existing power supply

Image: Qld Ag Energy Hub



OVERVIEW

Energy storage means holding energy so it can be used at a different time to when the energy is generated or purchased. For rural and regional businesses, this is most commonly about capturing solar energy during the day and using it later when energy demand is higher or when solar is no longer generating. Storage is becoming more important as more businesses look for ways to improve energy reliability and reduce energy costs.

There are three main types of storage relevant to rural and regional Australia:

- **Battery storage:** Battery Energy Storage Systems (BESS) store electricity directly. Cheap grid energy or excess solar energy charges the battery during the day, and the stored electricity can then be used when needed.
- **Thermal storage:** Thermal storage stores energy as heat or cooling. Examples include insulated water (hot or chilled) or glycol tanks, and ice storage. These systems use surplus electricity or waste heat to heat or cool something during the day (e.g. heat pumps, boilers and refrigeration systems) so the stored energy can be used later.
- **Mechanical storage:** Mechanical storage stores energy in movement or pressure. Examples include flywheels (using rotational kinetic energy from a spinning rotor or flywheel for smoothing peaks or stabilising power), pumped hydro, and compressed air energy storage (storing compressed air in a tank or underground storage for later release and expansion to generate energy to drive mechanical work).

SUITABLE BUSINESS TYPES

Energy storage is most valuable where there is either high energy use, variable demand, a need for reliability in an unreliable system, or for businesses that may be exporting surplus energy generated on site. Examples include:

- Businesses which require higher energy usage throughout the day or at critical times, such as refrigeration for butchers, poultry farms, and food processing facilities; or where outages can have serious operational or animal welfare consequences. These businesses tend to have relatively predictable energy use, which can make it easier to size and get a return on storage systems.
- Businesses where the peak energy usage coincides with peak electricity prices, for example cropping – particularly where smaller electric pumps are used. In these cases, storage can help shift peak demand to times when electricity is cheaper.
- Remote properties, off-grid systems, or where water pumping and household energy use are key considerations.
- Businesses that already have heating or cooling equipment and sufficient land area for water to be heated or cooled and stored for peak demand periods, e.g. dairies, nurseries and greenhouses.
- Businesses that have the potential to use otherwise wasted heat.

BENEFITS

Adding on-site energy storage can offer a number of potential benefits, including:

- Supporting better use of solar energy production by storing excess daytime solar, then allowing use during peak energy prices and increasing self-consumption.
- Reducing peak demand and costs by smoothing large loads. This is achieved by drawing power from a battery, or drawing hot water from a storage tank.
- Improved reliability and backup where batteries allow continuous critical power supply during power outages, reducing reliance on both unstable grids and diesel generators.
- Supporting electrification by enabling switching from diesel/gas to electric.
- Allowing existing systems to be retrofitted, for example by adding an additional hot water storage tank, or using a spare dairy vat for chilled water storage. A thermal storage system may also achieve efficiencies by allowing equipment such as chillers to run at a more efficient operating level to heat or cool water.
- Where market mechanisms are available, stored electricity can be exported during periods of high demand or high prices.

CHALLENGES

Some of the challenges to consider include:

- A level of complexity is involved in designing and sizing systems. Storage needs to be matched to both the energy use profile and the generation profile. If systems are undersized or poorly configured, the expected benefits may not be realised.
- Batteries can have a large upfront cost and the payback period depends on tariffs and usage.
- New large-scale battery systems will generally need approval by the local Distribution Network Service Provider (DNSP).
- Batteries degrade over time (10–15 years is typical), and discharging batteries too deeply can reduce the lifespan. Thermal systems are simpler but still require maintenance, and mechanical systems are less common so there are fewer suppliers.
- Thermal management of batteries can be required in hotter rural environments.

TECHNICAL CONSIDERATIONS

Understanding your energy needs

- Implementing an energy storage system requires an understanding of the scale of energy use and use patterns. Patterns over one or two years should be reviewed to determine the suitability of storage and to design the right system. This is increasingly supported by the use of smart meters.
- It is important to consider how energy storage will be used, including whether there is already enough energy produced on site to allow for storage, when this excess energy is being produced, and when the stored energy will be used.
- Round trip efficiency is the proportion of power available after any losses in the transfer of power. There are higher losses associated with flywheels and compressed air storage, as mechanical work is required to store and recover the energy through a turbine. The system must be designed to ensure sufficient energy will be available after accounting for power losses.

Technology type

Different technology types come with different considerations. Some of the key considerations for each technology type are listed below:

Batteries

- Whether the battery is grid-connected or required to have off-grid capability.
- The size of the inverter needed to support the necessary power draw at equipment start up.
- Whether switchboard upgrades and protection are required.
- The depth of discharge available to ensure system sizing is large enough to avoid drawing the battery down to the extent that it affects battery life.

Thermal storage

- If a new system is being considered, consider whether there is sufficient physical space for the thermal storage tanks and other equipment.
- Where there is a heating or chilling system already in place, such as an electric storage hot water system, consider whether the storage tank can be expanded or connected to another tank to increase storage capacity.

Mechanical storage

- Mechanical storage systems like flywheels are usually packaged units that connect into the electrical system. They are more commonly used in industrial settings which will generate large power draw on start up. This means both the power rating (kW) and the storage capacity (kWh) need to be carefully considered.

IMPLEMENTATION CONSIDERATIONS

Suppliers or service providers

- Solar and battery installers are usually the main delivery channel, supported by electrical contractors and, in some cases, energy consultants for larger or more complex systems.
- For thermal storage, plumbers and HVAC or refrigeration specialists are often engaged in the design and installation.

Skills or training required

Most systems are designed and installed by specialist providers, and proper commissioning and instruction should be provided as part of the installation process so that the user can maximise the benefit of the battery.

DECISION FACTORS

When this option may make sense

Energy storage makes the most sense where there is a clear mismatch between when energy is generated and when it is used, and where this mismatch has a financial or operational impact.

Storage is particularly well suited to sites with existing or planned solar systems, high evening or overnight energy use, significant peak demand charges, or reliability concerns. It is also attractive where diesel is currently used for backup or off-grid supply.

When it may not be suitable

Factors that may reduce the effectiveness of a storage system include:

- Businesses with low energy use, flat tariffs, or highly reliable and low-cost grid supply.
- Where there is no solar generation, as the value of storage is reduced.
- Large or occasional energy use that spikes for short periods, such as seasonal irrigation pumps, flood lift pumps, or ventilation in intensive animal sheds on hot days. In these cases, it is often not economical to install enough storage to cover short bursts of high use.

Key decision criteria

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

- Storage should be considered as part of a broader energy strategy rather than as a standalone investment. Starting with an understanding of energy use on-site, then optimising efficiency and solar, and finally assessing storage, is often the most effective approach.
- Costs vary widely depending on system size and configuration. Small battery systems of 10kWh suitable for homes or small businesses may range from around $10,000 to $25,000. Larger farm-scale systems can range from $50,000 to several hundred thousand dollars or more.
- Thermal storage systems are often significantly cheaper, particularly where existing infrastructure can be adapted. Costs may range from a few thousand dollars to tens of thousands depending on scale.
- Mechanical storage systems such as flywheels are less common and costs are more variable. They are generally used in niche applications.

SPOTLIGHT.

DETERMINING YOUR ENERGY STORAGE NEEDS

There are a number of programs that help small-to-medium enterprises (SMEs) determine the most effective energy reduction and energy storage options for them. Examples include:

SunSPOT - Built by UNSW and the Australian PV Institute, SunSPOT helps you work out how much you could save with solar and batteries, what size solar system will fit on your roof, and which battery options suit your needs.

Pathfinder - The Towards Net Zero Agriculture Pathfinder looks at a range of agricultural emissions reduction options, including the use of solar and energy storage.

SME Industrial Decarbonisation Fund - Australian Government funding that supports SME manufacturers to lower emissions through renewable energy solutions (including electrification and energy storage).

STAND-ALONE POWER SYSTEMS

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

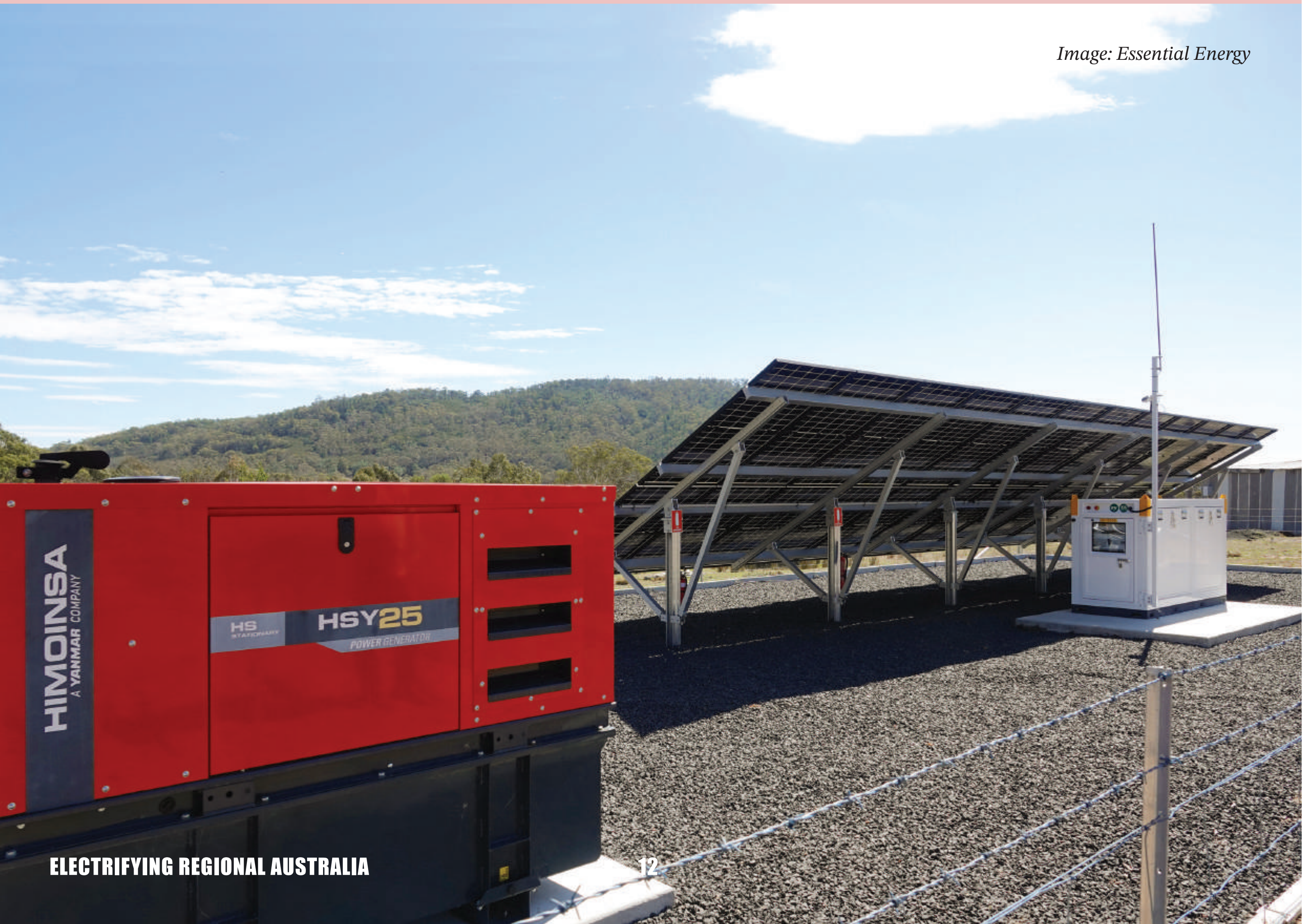


Image: Essential Energy

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 undersized 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

ELECTRIFICATION OF STATIONARY EQUIPMENT

AT A GLANCE

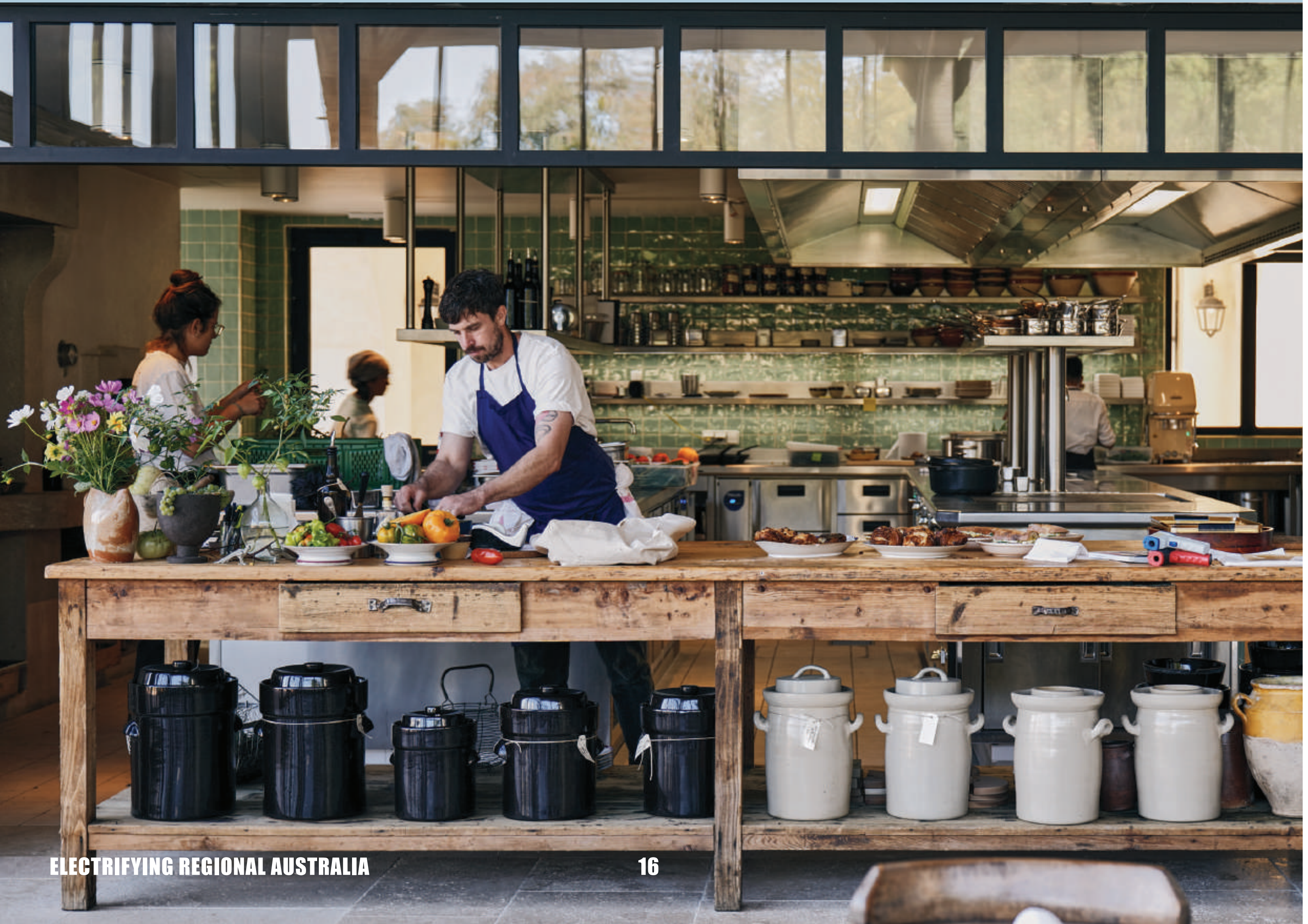
Best suited to:
Businesses using gas for heating, cooling, hot water or cooking, or that rely on diesel-operated equipment

Main benefit:
Lower operating and maintenance costs

Main barriers:
Ensuring a reliable power source for critical operations

Good first step:
Determining how to source the necessary power supply

Image: Making the Switch



OVERVIEW

Electrification of stationary equipment involves replacing diesel or LPG-driven engines with electric motors or gas-powered equipment with electric equivalents. Equipment is typically powered by grid electricity, on-site solar (often paired with batteries), or a hybrid of both.

Electric motors are typically more efficient than internal combustion engines at converting energy into useful mechanical work such as pumping, driving machinery, refrigeration, and vehicle movement. Using electric motors results in lower energy costs and lower maintenance costs, as there are fewer moving parts and no oil changes.

Electrification of equipment means that systems can be paired with solar to provide power for daytime activities. Batteries can be added where activities, such as refrigeration, need to extend beyond daylight hours, or where grid reliability is an issue. With grid-connected systems, businesses have the potential to export excess energy generation for additional income or use off-peak electricity strategically.

SUITABLE BUSINESS TYPES

Businesses that could benefit from electrification of stationary equipment include:

- Homes and businesses with gas heating, hot water, or cooking appliances.
- Businesses with equipment powered by generators, or equipment that relies on stationary engines, such as workshop equipment.
- Businesses relying on refrigeration (e.g. cold storage) or ventilation systems.
- Businesses relying on diesel pumping and irrigation systems.
- Dairy milking and cooling systems, grain handling and drying, or feed systems.

BENEFITS

There are a number of potential benefits to electrifying stationary energy applications:

- Lower operating and maintenance costs compared to diesel equipment.
- Opportunity to integrate with renewable energy for greater energy independence and reduced exposure to fuel price volatility and supply disruptions.
- Environmental benefits including reduced noise, lower carbon emissions, and reduced localised pollution.
- Potential eligibility for government incentives or carbon certificates, e.g. Energy Saving Certificates in NSW for switching from diesel to electricity and solar.

CHALLENGES

Some of the challenges to consider include:

- Ensuring a reliable power source for critical operations where power supply is variable, or where there are grid capacity limitations (this could require network upgrades).
- Upfront capital cost for electric equipment, especially if infrastructure or network upgrades are required.
- Uncertainty around battery lifespan, replacement costs, and resale value.
- Lack of expertise regionally for repairs or maintaining some electric equipment.

TECHNICAL CONSIDERATIONS

Grid connected

- Whether single-phase or three-phase power is required and available.
- Understanding the available capacity in the local network. Grid augmentation or transformer

upgrades could be required if larger high-voltage lines are needed to import larger quantities of power.

- Whether there is stable voltage. Long rural lines can experience voltage drops, especially during motor startup.
- The costs of managing peak versus average demand. Utilities may charge based on peak demand, not just energy use, and there may be time of day load constraints.
- Whether the grid is sufficiently reliable for consistent power draw, particularly for high-use operations.

If grid power is limited, you may need to go off-grid or use a hybrid system consisting of solar, battery, and possibly a diesel backup generator.

Off-grid or hybrid

To correctly size your transformer, cables, battery and inverter, you'll need to consider:

- **Peak demand:** You need enough power or battery storage to match your peak demand. Off-grid or hybrid systems can work well when paired with solar and battery storage, or bioenergy production.
- **Motor startup current:** Motors draw a surge when starting up – pumps and compressors can draw 3–7 times their running load.
- **Duty cycles:** Match continuous loads (like refrigeration) and intermittent loads (like irrigation) to the energy supply available.

IMPLEMENTATION CONSIDERATIONS

Incremental application

If a site is already connected to the electricity network, electrification can happen incrementally. For example:

- Gas hot water and heating can be replaced with heat pumps and inverter air conditioners in stages.
- On a farm or business such as a dairy, gas hot water heating or a diesel pump can be replaced with an electric equivalent at different times.

Skills or training required

- Basic understanding of electric systems and charging management.
- Training for operators and mechanics in safe use and maintenance of electric equipment.
- Access to energy management and optimisation skills, particularly when integrating renewables.

DECISION FACTORS

When this option may make sense

- Your business has high fuel costs, especially if you have the potential to offset energy purchases with on-site renewable energy production.
- Solar power is already being exported regularly.
- Where electrification can also enable more efficient, smarter operation with timers, high efficiency variable speed drive systems and remote controls which can optimise water and energy use.
- There is existing excess grid capacity.
- Emissions reduction or sustainability targets are a priority.
- Diesel transfer pumps are used for water transfer.
- You are an irrigator who irrigates all year round or has storage dams allowing irrigation timing to be controlled. Irrigation pumps are particularly well suited to conversion because they are at fixed locations, often on predictable schedules, and already rely on mechanical drive systems that can be efficiently converted to electric.

When it may not be suitable

- Your business operates in remote locations with limited grid access and insufficient capital for off-grid systems.
- Equipment use is highly variable or runs for long durations.

Key decision criteria

Some factors to consider when deciding whether electrification of stationary equipment is right for you:

- What the most appropriate technology combination is for your business. This could include grid electricity, solar only, solar and battery, or hybrid (a mix of solar and grid and diesel backup).
- Whether the grid is strong enough to supply the load (or additional load) and, if not, the cost of upgrades versus off-grid or hybrid systems.
- Whether available electricity provides enough power for the task for long enough, or whether backup generation would be required.
- Whether electrification would require a new connection to the network. Electrical infrastructure (poles and wires) can be expensive. Prices increase if there are long cable runs, trenching costs, remote pumping sites, and distributed loads. Solar plus batteries can be cheaper than extending the grid.
- Whether there is access to service, support and expertise locally to fix and repair electric equipment and the lead times for new parts.
- The total cost of ownership (capital versus operating savings) and what financing could be available.
- Whether electric equipment is compatible with existing business systems and workflows.
- Equipment performance requirements (power, duty cycle) and whether these can be met through the available or proposed energy supply.
- Whether electrification aligns with long-term business goals, including sustainability and risk management.

CASE STUDY.

MAKING THE SWITCH

The Sustainable Restaurant Association, in collaboration with the Global Cooksafe Coalition and Hospitality Energy Saving & Sustainability, has released Making the Switch, a step-by-step guide to switching from gas to electric equipment in restaurants.

The Global Cooksafe Coalition looked at electrification in a gastropub, a Chinese takeaway restaurant, and an Indian restaurant in the United Kingdom, and adapted the findings to the Australian market. The research found that, on average, the three restaurants could save 43% on energy costs, cut energy use by 58%, and reduce carbon dioxide emissions by 26% by switching to electric. All three restaurants are expected to recoup the cost of new electrical equipment within three years.

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For more information see: cooksafecoalition.org/making-the-switch

ELECTRIFICATION OF VEHICLES AND MACHINERY

AT A GLANCE

Best suited to:
Businesses relying on light vehicles and shorter travel distances

Main benefit:
Lower operating and maintenance costs

Main barriers:
Upfront capital costs, charging limitations, and the availability of larger electric farm machinery

Good first step:
Determining how to source the necessary power supply

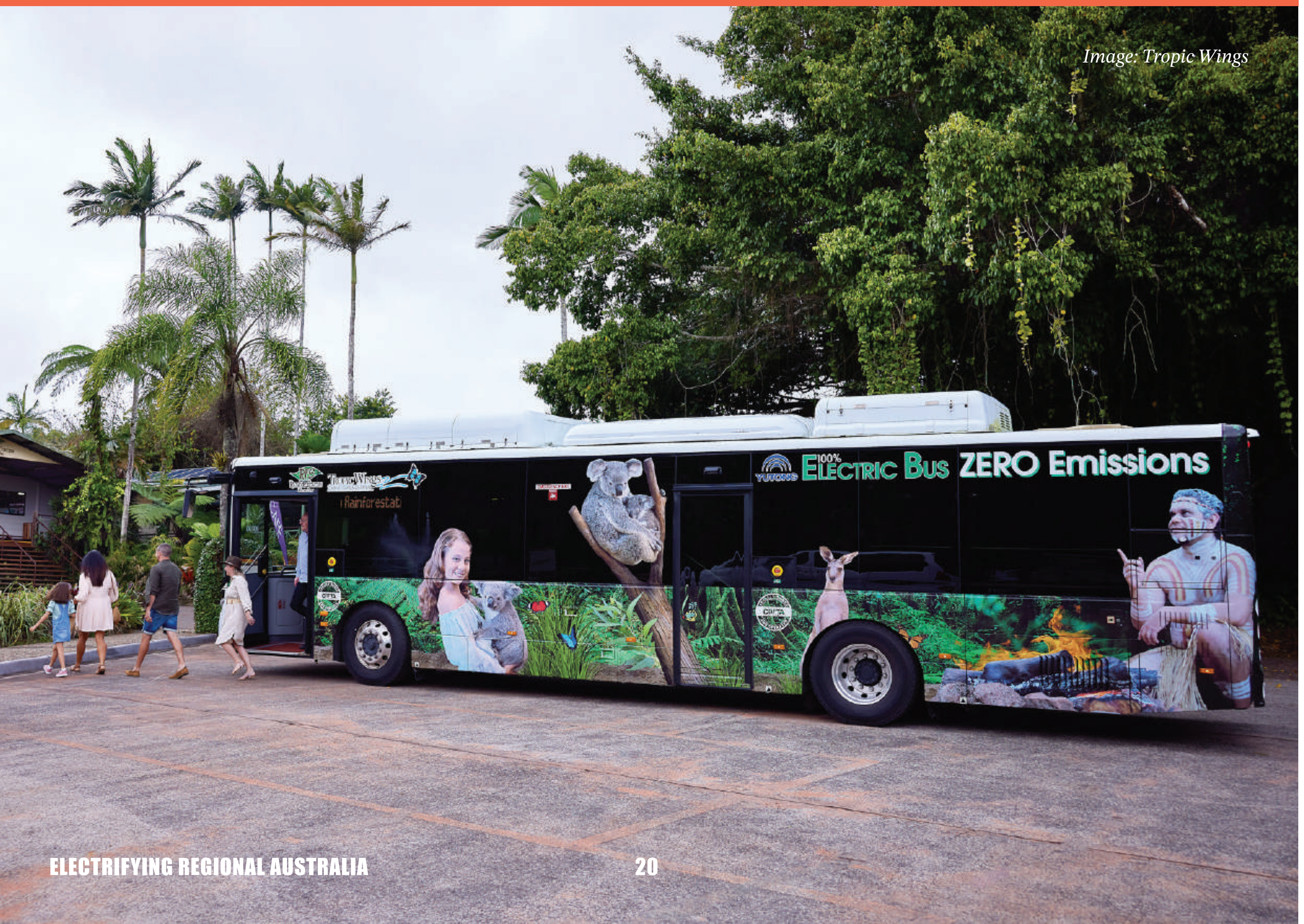

Image: Tropic Wings

OVERVIEW

Electrification of vehicles involves replacing vehicles driven by internal combustion engines with vehicles driven by electric motors. Electric vehicles (EVs) and machinery have batteries instead of fuel tanks.

The purchase of electric passenger and light commercial vehicles in Australia is growing rapidly. A wide range of electric equipment for farms and workshops is also available, with extensive use of forklifts, all-terrain vehicles (ATV), and motorbikes in rural and regional Australia.

Electric tractors are slowly entering the market, especially in the small/medium sizes while heavy duty, high horsepower tractors will emerge as the next frontier.

SUITABLE BUSINESS TYPES

For rural transport and delivery businesses, there are many electric light vehicles (cars and utility vehicles) available on the market – though range anxiety and the availability of charging infrastructure remain big concerns.

Many modern EVs can travel 300–500 km on a single charge, which covers most daily needs. However, long-distance travel requires planning of charging stops, and ensuring availability of compatible charging spots. Charging overnight, using a workplace or depot for charging, or planning routes with fast charging on highways can aid EV use.

For storage, depot, and stationary service styles of business, electric workshop vehicles and forklifts are readily available.

For farming businesses, side-by-sides and utility vehicles, motorcycles, and quad bikes are readily available – and small tractors are increasingly available as well. Intensive operations like dairies, piggeries, wineries, nurseries, and horticulture are highly suitable for vehicle electrification due to the short travel distances, predictable and repetitive vehicle use, and centralised operations (supporting ease of charging).

BENEFITS

There are a number of potential benefits to electrifying vehicles and machinery as they become available. These include:

- Lower operating and maintenance costs compared to diesel or petrol vehicles.
- Reduced exposure to fuel price volatility and supply disruptions.
- Environmental benefits with lower greenhouse gas emissions.
- Opportunity to integrate with renewable energy for greater energy independence.
- Reduced noise and the elimination of exhaust fumes.
- Charging electric vehicles on-site is potentially a flexible load that can be operated during periods of surplus solar generation or times of cheaper grid electricity.

CHALLENGES

Some of the challenges to consider include:

- Higher upfront capital cost for electric equipment and supporting infrastructure.
- Charging time constraints can impact operational flexibility.
- Grid capacity limitations in some regional areas.
- Uncertainty around battery lifespan, replacement costs and resale value.
- Lack of regionally available expertise for repairs or maintenance.
- The need for isolation equipment if grid stability is an issue (i.e. equipment that provides the ability for solar and batteries to operate off-grid and continue to charge vehicles in an outage).

TECHNICAL CONSIDERATIONS

Understanding energy usage

Some matters to consider:

- Energy and load management systems are important to optimise charging times, manage electrical loads and avoid peak demand charges or grid constraints.
- Whether being able to charge vehicles during a grid outage is important to your operations. This may require isolation mechanisms that disconnect the system from the grid so that it can run on solar, batteries, and the generator during a grid outage.
- What charging practices will lead to the most effective load management and the best value for money. Staggered or overnight charging for vehicles can reduce peak demand and infrastructure costs.

Suitable power supply

- You will require a power supply that can provide enough electricity to charge the machines. Consider the power supply requirements of each vehicle, as the speed and frequency of charging will affect the electrical system capacity needed.
- Consider where there is more than one place on the property that charging infrastructure could be installed.
- Consider the time it takes to charge batteries for electric vehicles and how the charging time will fit with the workflow of the business or any anticipated travel.

Infrastructure needed

- Sufficient and reliable power supply must be available for charging. Chargers can range from standard chargers to fast chargers depending on fleet size and usage patterns.
- Electrical upgrades such as switchboards, transformers, wiring, or grid augmentation may be required.
- Potential for EVs to be integrated with renewable energy systems such as solar, battery storage, or bioenergy production.
- Whether off-grid or hybrid systems are feasible when paired with solar and battery storage or bioenergy systems.

IMPLEMENTATION CONSIDERATIONS

Land and space requirements

- Dedicated space is required for charging stations and potential battery storage systems.
- Sufficient area for solar installations (rooftop/ground-mounted or elevated over crops) is required if pursuing off-grid generation.
- Ensuring a safe storage area for electric vehicles and equipment and the associated charging infrastructure might change the way traditional vehicle storage areas are used.

Skills or training required

- Training to help you get the best performance from your equipment, including working out optimal charging times.
- Training for operators and mechanics in the safe use and maintenance of electric equipment.
- Access to energy management and optimisation skills, particularly when integrating renewables.

Automation

- The development of electric equipment and machinery is occurring alongside rapid advances in automation. For example, some electric tractors are being designed with autonomous capabilities, which may reduce the inconvenience of charging times by allowing tasks such as weed spraying to operate continuously, including overnight, without needing an operator.

DECISION FACTORS

When this option may make sense

- Your business has high fuel costs, especially if you have the potential to offset energy purchases with on-site renewable production.
- Solar power is already being exported regularly, which may mean enough spare capacity to charge an electric vehicle, forklift or ATV.
- Vehicle usage is short and predictable.
- There is existing grid capacity to support the increased charging requirements.
- Emissions reduction or sustainability targets are a priority.

When it may not be suitable

- Your farm is large-scale and broadacre, requiring continuous, high-horsepower machinery.
- You're in a remote location with limited grid access and insufficient capital for large amounts of solar.
- Equipment use is highly variable or runs for long durations.

Key decision criteria

Some factors to consider when deciding whether electrification of vehicles and machinery is right for you:

- The most appropriate technology combination to power charging. This could include grid electricity, solar only, solar and battery or hybrid (a mix of solar and grid and diesel backup).
- The presence of constraints such as whether the grid has enough capacity to fast-charge equipment (if necessary) and if not, what the cost of upgrades versus off-grid charging would be.
- Whether there is local access to service, support, and expertise to fix and repair electric equipment, factoring in the lead times for new parts.
- The total cost of ownership (capital versus operating savings) and what financing could be available.
- Whether electric equipment is compatible with existing business systems and workflows.
- Equipment performance requirements (range, power, duty cycle) and whether these can be met through the available or proposed energy supply.
- Whether electrification aligns with long-term business goals, including sustainability and risk management.

CASE STUDY.

TROPIC WINGS BUSES

Tropic Wings, a tourism operator located in Cairns, was the first private operator of an electric bus in Australia, starting back in 2019. In 2023, through an Australian Renewable Energy Agency (ARENA) trial, Tropic Wings introduced a further 12 battery electric buses into its fleet of 34 vehicles. Eleven chargers were also installed at their depot and one of their major tourism destinations, Rainforestation in Kuranda.

For the change to electric vehicles to be successful, the company needed to consider multiple regulatory and technical challenges – from flood-resilient construction to optimising site layout and power flow. To get the help they needed, Tropic Wings worked with their energy retailer to assess grid capacity and design appropriate load-management systems.

In 2024, the company installed a battery energy storage system (BESS) to provide redundancy, minimise grid impact, and reduce operational costs. Currently the company has 19 electric buses, which is 45% of the fleet.

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For more information see: arena.gov.au/assets/2026/05/Tropic-Wings-Sustainable-Transport-in-Tourism-Industry-Blueprint-for-the-Deployment-of-Electric-Buses-by-Private-Operators.pdf

HEATING

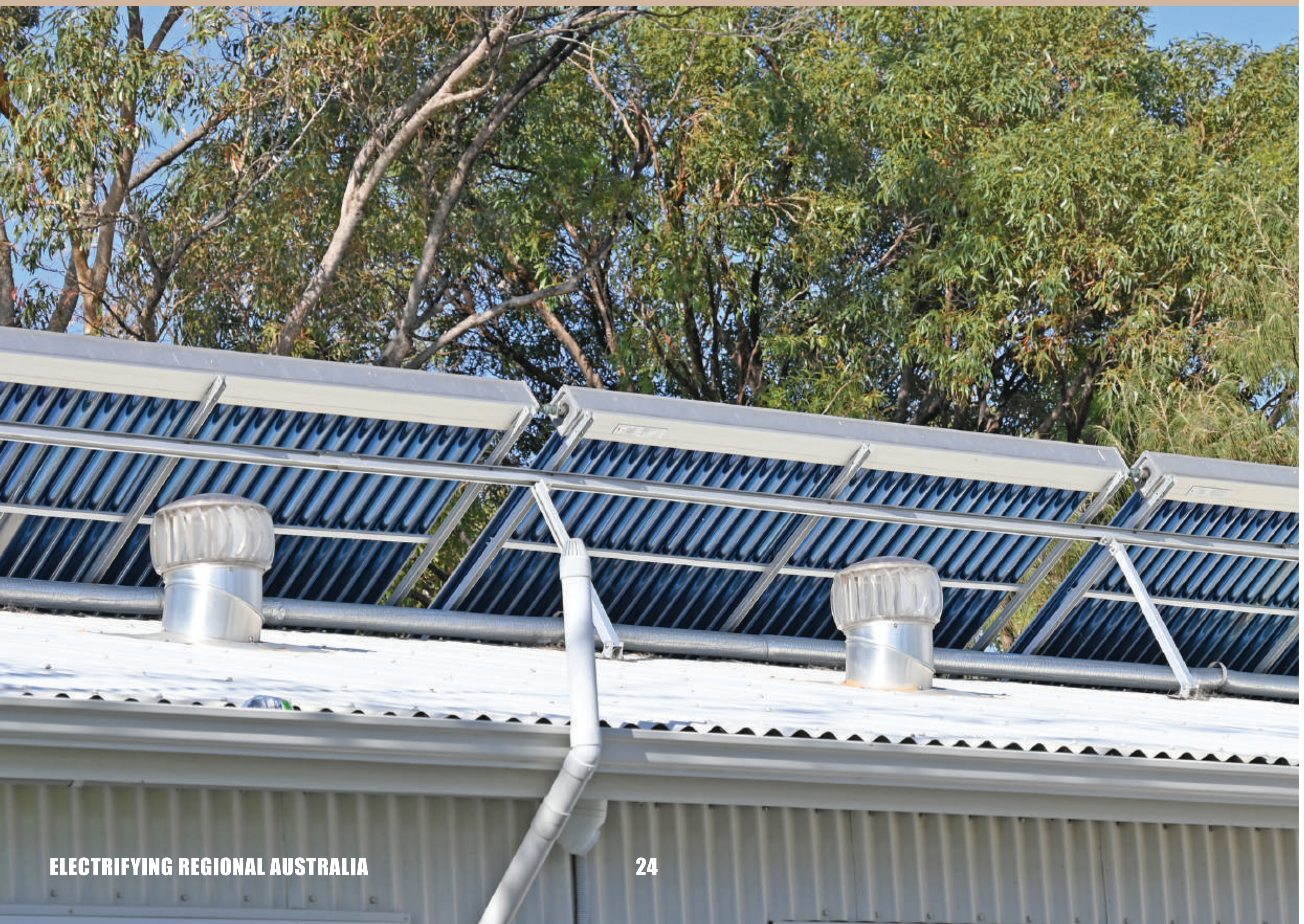
AT A GLANCE

Best suited to:
Businesses with significant energy use for heating

Main benefit:
Improved efficiency and reduced fuel handling costs

Main barriers:
Identifying the system that best matches energy loads

Good first step:
Maximising efficiency and building on existing systems



OVERVIEW

Heating is a major source of energy use in rural and regional areas. It includes space heating in homes and sheds, water heating for cleaning in food service and dairies, and process heat used in activities such as drying, pasteurisation, and cooking. Heat is produced in a range of ways, including gas and LPG burners and boilers, diesel boilers, and electric resistance heating.

There are a number of electric alternatives that can provide heating more efficiently and cleanly. Technologies that support efficient electric systems powered by renewables include:

- Heat pumps, including air-source and ground-source. (Heat pumps are the technology that drive devices such as reverse cycle air conditioners.)
- Solar thermal or solar hot water systems.
- Electric heating for cooking.
- Heat recovery from existing systems, such as refrigeration and compressors.
- Hybrid approaches that combine new electric technologies with existing equipment.

These systems are generally implemented by:

- Purchasing new equipment such as heat pumps or solar hot water systems, and heat exchangers when purchasing new compressors or refrigeration systems.
- Retrofitting heat exchangers to existing compressors or refrigeration systems. Useful heat is often already being produced as a by-product of other processes, such as refrigeration and air compressors, but this heat is often wasted. Capturing and reusing heat can be simple and cost-effective.

SUITABLE BUSINESS TYPES

Regional businesses with significant heating needs that could be electrified include:

- Accommodation such as hotels.
- Health sites such as hospitals.
- Catering and food service businesses including restaurants, pubs, and clubs.
- Manufacturing applications such as steam flaking in feed mills, parts washing in workshops, and cooking, cleaning, and sterilisation in food processing, such as meat processing and in dairies.
- Intensive animal production systems, including piggeries, poultry farms, and dairies.
- Horticulture and nurseries with on-site propagation or processing.

BENEFITS

There are a number of potential benefits associated with electrifying heating and using more efficient systems, including:

- Electrified systems are generally easier to control and automate, allowing more consistent temperatures and alignment with operations.
- Changing from gas to electrified heating systems can reduce fuel handling time and logistics.
- Heat pumps can deliver three to five units of heat for every unit of electricity consumed. The efficiency of air source heat pumps can be improved by locating the unit close to a source of waste heat, such as the exhaust from a dryer.
- Strong opportunity to integrate with solar energy. Many heating loads, particularly water heating, can be shifted to daytime hours when solar generation is highest.
- Heat recovery is cost effective, as it provides heat that has been produced as a by-product of another process. Heat recovery systems are often relatively low cost compared to the savings they can deliver, particularly where they can be integrated into existing equipment. Thermal storage, such as hot water tanks, provide a simple and low-cost way to store this energy for later use.
- The system will largely run itself day to day, but monitoring energy use and performance can help make sure savings and benefits are being realised.

CHALLENGES

Some of the challenges to consider include:

- The upfront cost of implementation.
- Technical advice may be required for retrofitting heat recovery systems into existing infrastructure.

- Electrifying heating increases the electrical load, which may require upgrades to switchboards or connections. In rural areas, this can be a constraint if network capacity is limited.
- Some processes may require higher temperatures than standard heat pumps can provide, and some systems may require heating on demand which heat pumps or solar systems may not be able to provide.
- Cooler climates may require high-efficiency heat pumps.
- Unless paired with a renewable energy generation system, there could be increased exposure to rising electricity prices, as the extra load may increase energy consumption and push usage into a higher pricing tier.
- Solar thermal systems may need backup for longer cloudy or rainy periods.

TECHNICAL CONSIDERATIONS

Air-source heat pumps

- Performance depends on outdoor temperature, with efficiency lower in very cold conditions.
- Requires adequate airflow and suitable outdoor unit placement to manage noise, airflow, and maintenance access. Dusty areas may reduce efficiency.
- Can be combined with thermal storage or controlled to operate during solar generation or off-peak tariff periods.

Ground-source heat pumps

- Require sufficient land area or suitable geology for ground loops or boreholes.
- More stable performance than air-source systems because ground temperatures fluctuate less than air temperatures.
- Higher installation complexity means careful design and site assessment are important.
- Typically suited to larger or long-life installations in regions with suitable temperatures, where higher upfront costs can be justified by long-term efficiency gains.

Heat recovery systems

- Most effective where there is a consistent source of waste heat and simultaneous demand for hot water or heating.
- System sizing and controls are important to avoid over capitalisation.
- Retrofitting will require integration with existing refrigeration, compressor, or process systems.
- Often provide relatively short payback periods where large amounts of waste heat are currently generated and can be used on-site.

Solar thermal systems

- Performance depends on solar availability, orientation, shading, and storage capacity.
- Storage sizing is important to balance daytime heat collection with overnight or peak demand use.
- Backup heating is generally required for long cloudy periods or high-demand events.
- Pipe insulation, freeze protection, and maintenance of pumps and collectors are important technical considerations, particularly in harsher climates.
- Solar thermal is often not as cost effective as solar panels and heat pumps combined. It is important to assess/compare the cost benefits carefully.

IMPLEMENTATION CONSIDERATIONS

Suitable power supply

- Electrified heating systems increase electricity use and can add to peak demand, so available electrical capacity should be assessed early. This is particularly important for rural sites or properties located at the end of the power lines.
- Pairing systems with solar, thermal storage or batteries can help reduce peak demand and improve operating costs.

Suppliers or service providers

- Heat pumps are often a relatively simple replacement for domestic or small-scale hot water systems, but larger applications such as pools, nurseries or horticulture usually require specialist design and commissioning.
- Most systems require specialist installation by Heating, Ventilation, and Air Conditioning (HVAC) contractors, mechanical engineers, or experienced electricians, particularly for heat recovery or industrial applications.

DECISION FACTORS

When this option may make sense

- There is a consistent demand for heat or hot water.
- Sites using LPG, diesel or gas are often strong candidates for electrification, particularly where fuel costs are high or fuel supply is difficult.
- You have existing refrigeration, cooling or compressed air systems, which may offer heat recovery opportunities.
- Solar generation can improve the economics by allowing heat generated during the day to be stored for later use.

When it may not be suitable

- Sites with low or irregular heating demand may find it harder to obtain a reasonable payback period.
- Applications requiring high temperatures or with limited electrical capacity may need more detailed assessment.

Key decision criteria

Some factors to consider when deciding whether heating and storage is right for you:

- Understanding the timing, size and profile of heating demand is critical when selecting the most suitable system.
- The presence of existing systems that generate waste heat, such as refrigeration, cooling, or compressed air systems, means there is a good chance that useful heat is being lost and could be captured.
- The availability of solar energy can assist where heating loads can be shifted to daylight hours, including by pairing it with thermal storage.
- Costs vary widely depending on the technology and scale. Small air-source heat pumps for homes or small businesses may cost a few thousand dollars, while larger commercial systems can range from tens of thousands to over $100,000.
- Ground-source systems are typically more expensive and require bore installation or underground pipe loops and need only be considered where the climate is unfavourable for air-source heat pumps.

SPOTLIGHT.

FINANCIAL INCENTIVES FOR CHANGE

Governments across Australia have recognised the benefits of helping to deliver cost-effective energy savings for households and businesses by providing financial incentives to install energy-efficient equipment and appliances, including those related to heating. Various schemes also incentivise energy retailers and large energy users to reduce their use of fossil fuels.

The greenhouse gas emissions reductions associated with shifting to heat pump hot water systems and solar water systems mean there are a number of financial incentives available for moving away from gas and other fossil fuel-based technologies. These could include incentives under:

- Clean Energy Regulator **Small Scale Technology Certificates** (STCs).
- NSW Government **Energy Saving Scheme**.
- Victorian Government **Energy Upgrades Program**.

Queensland based businesses can access **ecoBiz**, a free sustainability program run by the Business Chamber Queensland, that helps Queensland businesses cut costs, reduce carbon emissions and resource use, and better manage climate change risks.

ANAEROBIC DIGESTION

AT A GLANCE

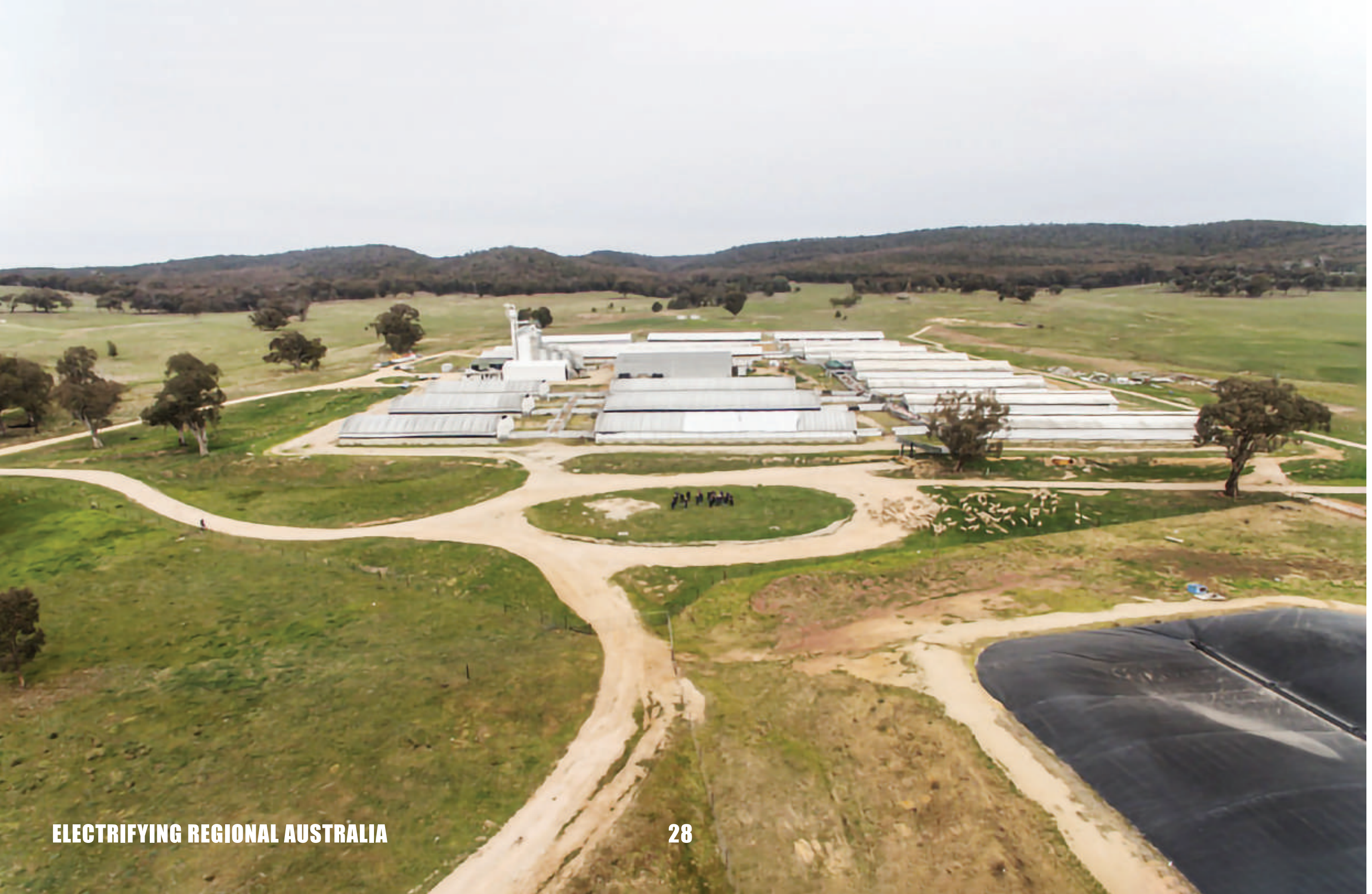
Best suited to:
Intensive livestock and food processing businesses

Main benefit:
Can help cover on-site power needs and manage waste

Main barriers:
Upfront costs and labour-intensive operation

Good first step:
Confirm the availability of long-term, reliable feedstock

Image: Blantyre Farms



OVERVIEW

Anaerobic digestion is a biological process where microorganisms break down organic materials (such as manure, food waste, or crop residues) in the absence of oxygen. As the nutrients are digested by bacteria, biogas is produced (mainly methane and carbon dioxide). The gas can be captured and used:

- Directly, by burning it for heating or in fuel boilers.
- To create electricity, by fuelling a reciprocating engine or gas turbine to operate equipment like chillers or dairy vacuum pumps, or to export to the grid.
- To produce biomethane which can be used as a replacement for fossil gas once the gas has been cleaned.

The remaining material (digestate) can be used as a nutrient-rich fertiliser.

BENEFITS

There are a number of potential benefits associated with anaerobic digestion, including:

- Systems can be designed to produce and store energy (electricity, heat, or biomethane) 24 hours a day.
- Environmental benefits including reducing carbon emissions through methane capture. Methane reduction incentives may be available.
- Manages waste and reduces odours.
- Produces digestate that can replace synthetic fertilisers.
- Potential to generate additional income by exporting excess energy to the grid or receiving payments under carbon credit systems.
- Improves nutrient management and bio-security.

SUITABLE BUSINESS TYPES

The most suitable business types produce a lot of organic waste or residue, such as manures or straws. Such business types include:

- Intensive livestock farms such as piggeries and feedlots.
- Food processing plants such as abattoirs.
- Horticulture with consistent crop residues (may need to be mixed with poultry or other similar waste).
- Wastewater management.
- Farms that collect liquid, slurry or semi-solid manure at a single point of collection every day or every second day.
- Businesses that can co-digest manure with feedstocks from nearby operations (e.g. fats, oils and grease, food waste, cheese or wine waste), which can increase biogas production – pre-processing equipment and holding tanks may be required.

CHALLENGES

Some of the challenges to consider include:

- High upfront capital costs mean a project's economic viability depends on scale and energy prices.
- Operation can be labour intensive.
- Each system is bespoke, designed according to the feedstock available.
- Systems require significant and consistent feedstock supply for the economic life of the project.
- Requires a good water supply (although this can be wash down or wastewater, as long as there isn't too much dilution).
- Operational complexity and maintenance needs – larger systems may need dedicated operational staff.
- There may be a long timeline for regulatory approvals, and there are compliance requirements to meet. Approvals are different for each state and can take years.

- Transport/logistics to bring sufficient feedstock can add cost.
- Compliance, such as with gas storage and environmental reporting, can be time consuming.

TECHNICAL CONSIDERATIONS

Infrastructure needed

A number of elements are needed for each system:

- Anaerobic digester tank – either an in-ground covered system or an above-ground sealed reactor.
- Feedstock collection and handling systems (e.g. manure scraping, pumps).
- Biogas storage system.
- Gas utilisation equipment (gas cleaning system and generator, boiler, or upgrading system).
- Digestate storage and handling facilities.

Grid connectivity

- While anaerobic digestion systems can operate off-grid, grid connection allows you to sell excess electricity (subject to local network rules). If grid export constraints exist, methane gas must sometimes be burnt off.
- Biogas can be used directly for heating without a grid connection.

IMPLEMENTATION CONSIDERATIONS

Land or space requirements

- Moderate space required depending on system size. Lagoons or covered ponds require more land; compact tank systems require less.
- Buffer zones may be needed for odour management.

Suppliers or service providers

- Most systems require specialist design and installation, which may not be available in some regions.

DECISION FACTORS

When this option may make sense

- Your business produces high levels of concentrated waste and has the space to establish an anaerobic digester.
- Your business incurs high waste disposal costs with waste suitable for anaerobic digestion.

When it may not be suitable

- You have limited capital or access to financing.
- You have low energy demand on-site.
- There is a lack of technical expertise or support available in your area.
- You run a small-scale or extensive grazing farm with dispersed manure.

Key decision criteria

Some factors to consider when deciding whether anaerobic digestion is right for you:

- The long-term availability and consistency of feedstock (i.e. waste volume).
- Whether co-digestion with external waste could help maintain a regular supply. This may involve additional costs for collecting the extra feedstock.
- Whether your electricity and heat needs align with the energy the produced gas can efficiently provide.
- Your proximity to grid, your grid capacity, and your access to energy markets for excess production.
- Costs for setting up anaerobic digestion facilities can be high, as the specification and design depend on volume and quantity of feedstock and the output.

CASE STUDY.

BLANTYRE FARMS

Blantyre Farms, near Young in New South Wales, is a mixed farming and livestock business combining broadacre cropping, beef, wool, and lamb production with an indoor piggery. The farm produces around 40,000 pigs each year and employs 40 staff.

Blantyre Farms uses piggery effluent to generate renewable electricity through an accredited biogas system. Effluent flows into a covered pond, where biogas is captured and refined into methane to run generators that provide electricity for the site. Excess renewable electricity is sold back into the national grid.

The system reduces methane emissions, with more than 100,000 carbon credits awarded since the project began. After biogas is harvested, solid effluent is spread on paddocks as fertiliser, reducing synthetic fertiliser use and helping grow grain that is fed back to the pigs.

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For more information see: blantyrefarms.com.au

ENERGY TRADING

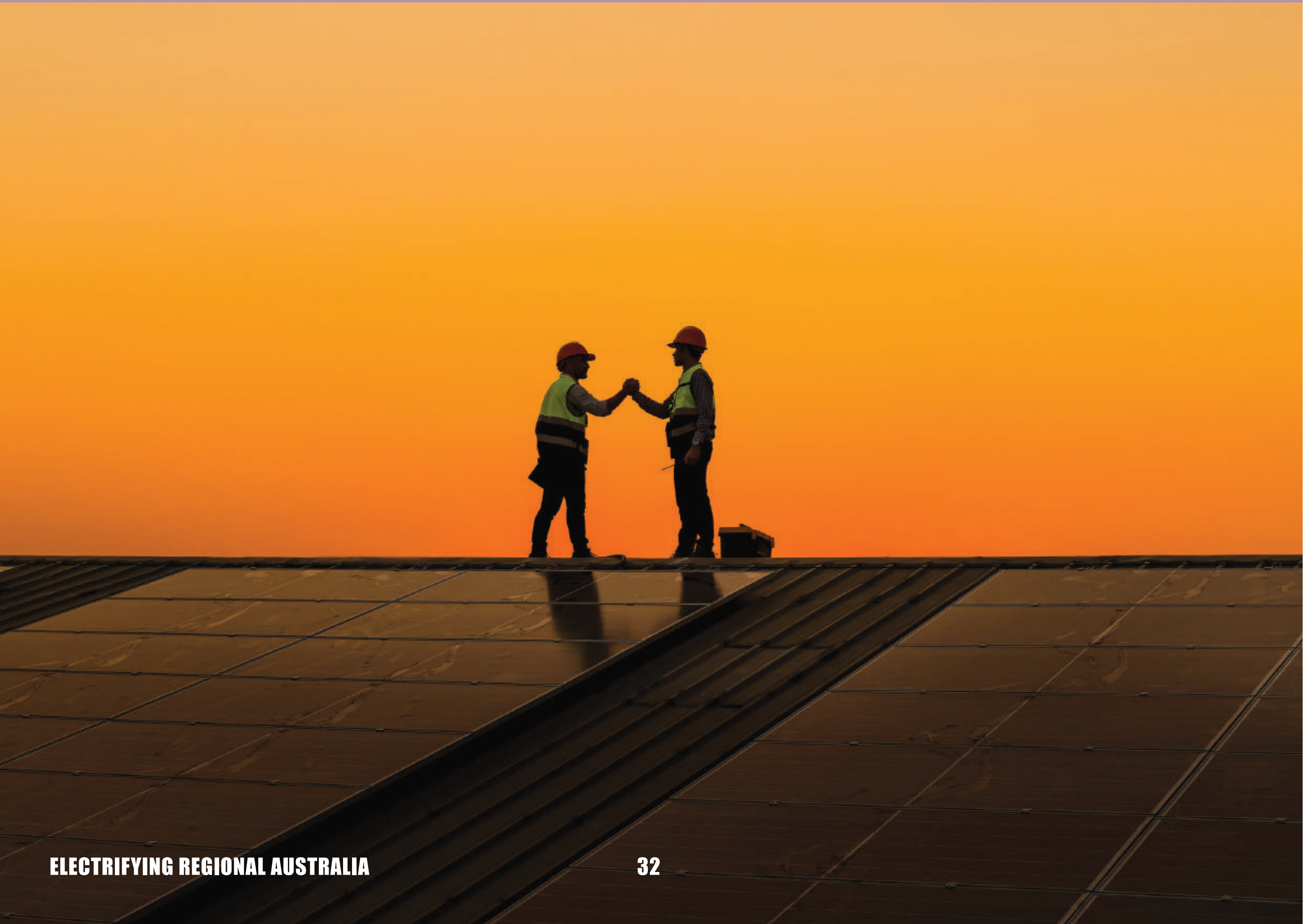
AT A GLANCE

Best suited to:
Businesses with existing solar and controllable loads

Main benefit:
Increased self-consumption with potential income generation

Main barriers:
Need to understand and respond to energy pricing in real time

Good first step:
Investigating existing Virtual Power Plant programs



OVERVIEW

As more businesses install solar, batteries, and smart electrical equipment, there is growing interest in how these systems can work together for shared benefit, rather than operating individually.

Virtual Power Plants (VPPs), Peer-to-Peer (P2P) energy trading, and local or Virtual Energy Networks (VEN) are all approaches that use software, communications systems, and smart meters (sometimes described as "soft infrastructure") to better coordinate energy generation, storage, and consumption across multiple sites.

A VPP links together distributed energy resources from different properties such as solar, batteries (and their inverters), hot water systems, pumps, and electric vehicles to operate in a coordinated way. A VPP operator such as an electricity retailer may remotely charge or discharge batteries, shift loads, or export power to support the grid or respond to electricity prices. VPPs can engage with energy trading and support energy system services, such as to correct voltage imbalances.

Peer-to-Peer trading allows electricity users to buy and sell electricity directly between participants, usually through a digital platform. For example, a business with surplus solar generation may sell energy to a neighbouring business.

Local or VEN arrangements allow groups of connected sites to share or allocate energy across multiple meters or locations.

While these concepts are developing rapidly, the regulatory and technical arrangements are still evolving in Australia, particularly in regional and rural areas. Currently only a small number of retailers offer VEN or VPP participation.

SUITABLE BUSINESS TYPES

These models are most likely to suit businesses that already have:

- Solar generation with some battery storage.
- Controllable electrical loads (e.g. the ability to shift usage times to respond to lower demand or high solar generation).
- Interval or smart metering.
- Good communications systems.

Intensive agriculture, food processing, and packing sheds may also be suitable because they often have existing technology that can support participation, including refrigeration systems, hot water loads, batteries, backup generation, and controllable processes.

Energy trading may also provide value in remote network areas where reliability is a concern, local solar generation is increasing but export may be constrained, network augmentation is expensive, and communities are looking for alternatives to diesel generation.

BENEFITS

There are a number of potential benefits associated with energy trading. For example:

Energy trading through connected distributed energy resources can help support electrification by:

- Managing increased electricity demand.
- Coordinating charging and storage.
- Reducing peak loads.
- Integrating flexible loads.
- Assisting with energy services like voltage management and emergency mechanisms.

Energy trading can support better use of solar by helping match local generation and demand across a number of businesses, thereby:

- Reducing curtailment of solar exports.
- Absorbing excess solar locally.
- Increasing self-consumption.
- Reducing low-value exports to the grid.

While the size and consistency of revenue streams can vary significantly, some VPP arrangements allow participants to receive payments for:

- Exporting energy during peak demand.
- Providing grid support services.
- Allowing batteries or loads to be controlled.
- Participating in demand response programs.

CHALLENGES

Some of the challenges to consider include:

- Australia's electricity system was not originally designed for widespread distributed trading between small energy users. VPPs and VENs are not available everywhere and are still emerging in a number of locations. As a result, regulations are still evolving and market access can be complicated.
- Poor internet connectivity in regional areas can prevent these systems from working effectively. Satellite internet services may improve viability in some remote areas.
- Revenue streams can be difficult to predict because they depend on wholesale electricity prices, network tariffs, market rules, the cost of operating the system, and the rate that can be paid for exported power.
- Participants need to become familiar with energy trading models and platforms (or identify a third-party to do this work for them), automated battery control, and data sharing requirements. There can also be concerns around third-party control of batteries, cybersecurity, privacy, and complexity of contracts.

TECHNICAL CONSIDERATIONS

Smart metering and good communications

These systems usually utilise solar and batteries behind-the-meter, and rely heavily on communications, software, and metering infrastructure to monitor and conduct energy trading. Most VPP and energy sharing systems require:

- Smart meters to track energy generation, imports and exports, and the timing of energy flows among participants.
- Communications connectivity to allow remote control systems and connection to cloud-based software.
- Remote monitoring capability for live monitoring and automated optimisation.

Controllable equipment

The value of these systems increases where businesses have flexible or controllable loads that can be automatically controlled to absorb surplus solar, reduce peak demand, and respond to electricity pricing. Such equipment can include:

- Batteries, inverters, and electric vehicle chargers.
- Electric hot water systems.
- Refrigeration systems.
- Thermal storage.
- Irrigation pumps.

Software and energy management systems

- A key component is the software platform that coordinates energy flows between participants or devices. If a rural feeder has export constraints, voltage issues, or weak communications, the software may help use the available capacity more intelligently, but it still sits within the limits of the local network.

IMPLEMENTATION CONSIDERATIONS

System upgrades

Implementation may require:

- Upgrades to smart meters, software, and communications between sites, and ensuring the compatibility of existing batteries or inverters.
- The assessment of current electrical systems and upgrades to meters and electrical wiring.
- Upgrades to internet connections.

Specialist design

More complex arrangements such as local energy networks or embedded networks generally require:

- Specialist design.
- Clear legal arrangements between participants.
- Energy retailer coordination.
- Network approvals.

DECISION FACTORS

When this option may make sense

- Your business has significant solar generation and battery storage.
- There is flexible electrical demand within and between participants.
- Export and network infrastructure constraints or poor reliability mean local energy sharing would be more useful.
- High peak demand can be supported by multiple energy generating sites located close together.
- There is strong interest in energy coordination, and communities are looking for local resilience solutions.

When it may not be suitable

- When electricity demand is low and/or the network is relatively stable.
- If communications are unreliable.
- When there is limited smart metering.
- When potential participants are uncomfortable with automation or third-party control.

Key decision criteria

Some factors to consider when deciding whether energy trading is right for you:

If you are unsure about connecting to a VPP, a practical starting point is often to install solar and monitoring, understand your load profiles, add controls to loads or storage (such as pumps, hot water, and batteries) and then assess VPP or coordination opportunities.

The simplest opportunities are often:

- Joining an existing VPP program, where available.
- Participating through a compatible community battery system.

In areas without an existing system, strong community networks can help set the scene for communities to develop a shared energy trading platform.

SPOTLIGHT.

VIRTUAL POWER PLANTS

Virtual power plants (VPPs) can be operated by existing electricity retailers or by third-party providers. In both cases, customers allow the retailer to access their battery at certain times, with the customer retaining different levels of control over when this happens. This access allows the VPP service provider to respond to different energy prices in real time during the day, allowing excess battery energy to be sold during peak periods.

Electricity retailers that support current residential customers and small businesses to participate in a VPP include:

- **Diamond Energy Wattbank VPP**.
- **EnergyAustralia Battery Ease**.
- **AGL Virtual Power Plant**.
- **Nectr Virtual Power Plant**.
- **Synergy Virtual Power Plant.**

Third-party retailers (i.e. companies that don't run network systems but act as a broker for energy) include:

- **Amber Energy SmartShift**.
- **Flow Power**.

COMMUNITY BATTERIES

AT A GLANCE

Best suited to:
Areas with high solar penetration

Main benefit:
Smoothing local power loads and increasing reliability

Main barriers:
Upfront costs and governance arrangements

Good first step:
Asking whether the local retailer supports community batteries

Image: TRY

OVERVIEW

Community batteries are shared battery systems connected to the local electricity network that can store and release electricity for the benefit of multiple households, farms, or businesses.

Rather than each property or business installing its own battery, a larger battery is installed in a neighbourhood, town, or industrial precinct. The battery charges during periods of high solar generation or low demand, and discharges when demand is higher or solar generation falls, or when network services are required (to improve network performance).

Different ownership and operating models are emerging in Australia, including:

- Distribution network-owned batteries – usually installed in areas where they can reduce network constraints, increase solar hosting capacity, and improve local network performance. In this situation, the benefit to customers may be indirect because the savings are shared across the whole customer base, and batteries are often treated as network infrastructure.
- Privately owned community batteries – owned and operated by a private company, which may earn revenue through services such as energy trading or demand response. Households, farms or businesses typically access the battery through a retailer, rather than owning the battery directly.
- Behind-the-meter batteries providing shared energy or grid services – larger battery systems installed on a private site, such as an industrial estate or shopping centre, where the battery primarily supports local energy use but may also provide wider grid or market services.

SUITABLE BUSINESS TYPES

- Regional towns with high rooftop solar penetration – particularly where local transformers or feeders are constrained, daytime solar exports exceed local demand, evening peak demand is increasing, and network upgrades are expensive.
- Businesses occupying multiple properties in close proximity, such as in industrial precincts with several businesses exporting solar at different times, or farming areas where different industries have different seasonal energy needs.
- Remote towns or fringe-of-grid businesses where there is reliance on diesel for a part of their generation.

BENEFITS

There are a number of potential benefits to participating in community battery arrangements, including:

- By charging and discharging strategically, community batteries can help reduce evening peak demand, smooth local loads, and defer expensive network upgrades.
- Improved resilience by supporting the local energy network with ancillary services, such as frequency control and voltage stability, and reducing stress on weak feeder power lines.
- Community batteries may allow businesses to benefit from battery storage without purchasing their own system, helping small businesses that cannot afford an individual battery or are operating on a site unsuitable for one.
- Privately or community owned batteries may help keep some of the economic benefits local, sharing profits with members through lower prices, or with the hosting business.

CHALLENGES

Some of the challenges to consider include:

- The regulatory framework can be complex, particularly where batteries provide multiple services. Rules are still evolving around ownership, energy sharing, network participation, and market access. For example, in some areas, private community batteries are able to earn revenues for grid support services, whereas in other areas they are not.
- Community batteries can involve significant upfront costs, including battery systems, transformers, civil works, communications systems, engineering and approvals.

- Financial returns depend heavily on reducing the upfront and operational costs, gaining customers to generate revenue, being able to price your energy competitively, achieving strong utilisation rates, and being able to monetise network benefits.
- Being clear on who benefits financially, who controls the battery, and who carries the risk of something going wrong is important. Financial benefits can be direct, or indirect through more reliable local power or savings on energy bills. Different ownership models can produce very different outcomes for communities.
- To effectively manage community batteries, battery managers need strong communications networks so they can access metering data and connect to network systems and battery controls in real time. These communications networks are not always available in rural and regional areas.
- Finding the best location for a battery.

TECHNICAL CONSIDERATIONS

Grid connectivity

- Need to establish whether the community battery can be integrated into the local electricity network. This may require engineering studies including network modelling, protection upgrades, and identifying approved export management systems.
- The availability of adequate control systems that allow the community battery to operate automatically – using software that responds to local solar generation, battery state of charge, electricity demand, and electricity pricing.

Project planning and collaboration

Developing a community battery usually involves:

- Network studies and engineering design.
- Community consultation, ongoing engagement, and market development (identifying potential customers).
- Planning and grid connection approvals.
- Software and communications integration and the installation of meters.

IMPLEMENTATION CONSIDERATIONS

Land and space requirements

- Consider whether there is sufficient space and suitable setbacks (depending on planning requirements).

Ownership model

Depending on the ownership model, community batteries are generally developed through collaboration between Distribution Network Service Providers (DNSPs), councils (for the necessary approvals), community organisations, and electricity retailers.

Batteries owned by the DNSPs may require less coordination as they will generally be installed on sites they already own or control, while private companies and communities will need to consider sites and network connections.

Community engagement

Successful development of community batteries often depends on:

- Clear ownership structures.
- Transparent benefit sharing.
- Good community engagement.
- Strong technical design.

DECISION FACTORS

When this option may make sense

Community batteries may be best suited in areas with:

- High solar uptake, with local production exceeding demand.
- Constrained export capacity.
- Growing electricity demand, especially in the evening peak.
- Network reliability concerns, especially where network upgrades are expensive.
- Interest in local energy solutions.

A strong commitment for participants to work together is required.

When it may not be suitable

- If your communications systems are not strong enough to access metering data and connect to networks and control systems in real time.
- If network constraints mean private community batteries are unable to earn revenue for grid support services.

Key decision criteria

The preferred ownership model may depend on:

- Local objectives.
- Access to capital.
- Regulatory arrangements.
- Desired customer outcomes.

In the case of behind-the-meter community batteries, the businesses may need technical advice to determine the most suitable size for the battery and consider:

- The long-term availability of low-cost daytime power to charge the battery.
- The ability to either use or discharge stored battery power during the evening peak when power prices are high.
- Any other revenues possible through network support services.

Costs vary significantly depending on size and complexity and can range from several hundred thousand dollars to many millions of dollars. There is also a range of ongoing costs including:

- Battery and hardware maintenance and facility management (i.e. buildings and grounds).
- Software and communications updates and maintenance.
- Operational management.
- Eventual battery replacement.

CASE STUDY.

TOTALLY RENEWABLE YACKANDANDAH

In 2021, Totally Renewable Yackandandah commissioned their first community-owned battery, Yack01. The 274 kWh battery and 65 kW solar installation is a behind-the-meter battery that can power 30-40 local homes overnight via the local energy provider.

In 2025, the community launched their second community battery, Yack02, a 200 kWh battery and 65 kW solar system located at the local Sports Park. In addition to providing power to the local network, this battery has a particular focus on reducing operating costs and supporting the Sports Park facility during power outages, ensuring that the kitchen, showers and toilets remain available to the local community. This could occur for minor outages or as designated by local authorities after emergencies.

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For more information see: totallyrenewableyack.org.au/watts-happening/yack01-community-battery

MICROGRIDS

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 m^2 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 communications 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

WHERE TO FROM HERE

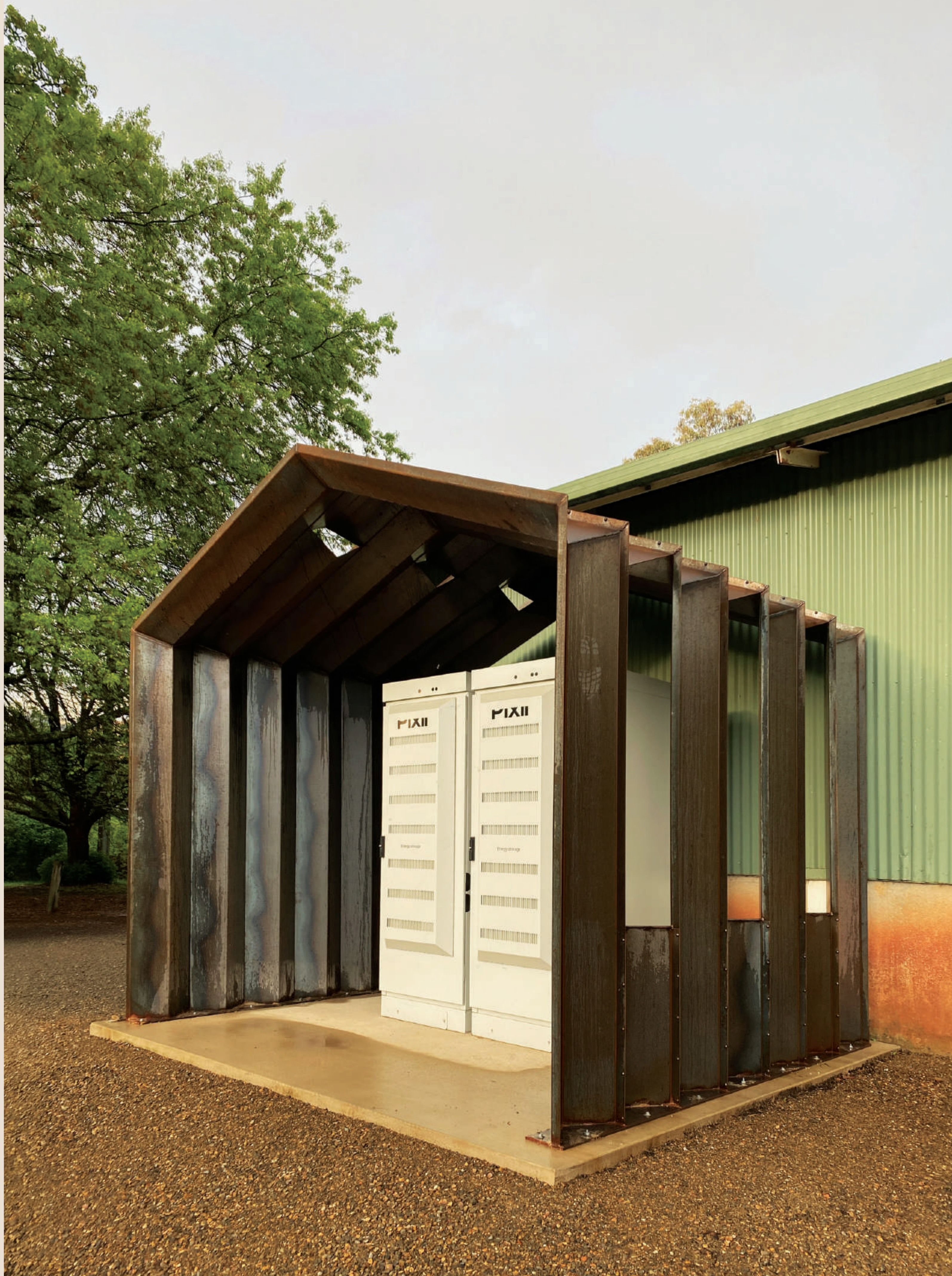
There's no single right way to electrify – it depends on your business, your energy use, and where you want to end up.

This guide is a starting point that we hope will help you on your electrification journey.

RE-Alliance
Call: 1300 290 982
Email: info@re-alliance.org.au
Visit: re-alliance.org.au

Farmers for Climate Action
Call: 1800 491 633
Email: info@farmersforclimateaction.org.au
Visit: farmersforclimateaction.org.au

Image: TRY



RE-ALLIANCE

farmers for climate action