Developing Resilient Energy Centres in Queensland

A how-to guide

RACQ

Community Power Agency

Contents

Acknowledgements

RACQ acknowledges the Traditional Custodians of the countries throughout Queensland and recognises their continuing connections to the lands, waters, and skies. We pay our respects to all Aboriginal and Torres Strait Islander cultures; and to Elders past and present. RACQ is proud to operate in a nation that is home to the oldest continuous culture on Earth, dating back more than 65,000 years and continues today. However, we recognise there is still much work for us to do to achieve meaningful reconciliation.

We acknowledge that reconciliation must live in the hearts, minds, and actions of all Australians as we move forward, creating a nation strengthened by respectful relationships. In partnership with Aboriginal and Torres Strait Islander peoples and communities, RACQ has pledged to become part of the solution through our Reconciliation Action Plan. This report has been prepared on the lands of the Wurundjeri people of the Kulin Nation and the lands of the Yuggera and Turrbal people.

Overview

About this guide

This guide is for community organisations, groups and clubs across Queensland who are interested in energy resilience solutions for community facilities. It covers practical steps from understanding community needs, to finding suitable buildings, technology considerations, and managing implementation. The focus is on achievable, small-scale behind-the-meter systems that community organisations can realistically maintain over time.

Introduction

Over the past decade, Queensland communities have faced increasingly frequent and severe weather events that regularly disrupt power supply. Cyclones, storms, and heatwaves can leave entire towns without electricity for days or even weeks. The Bureau of Meteorology expects these extreme weather events to become more common as our climate continues to warm.[1]

When severe weather hits, it often damages multiple power lines simultaneously. Storms, heatwaves, floods and other natural disasters can leave some areas without power for days and in some instances, far longer. These power outages impact people's ability to access potable water, keep food cold, charge phones, communicate with others and access emergency information.[2][3][4] These disruptions affect community wellbeing socially, economically, and emotionally.

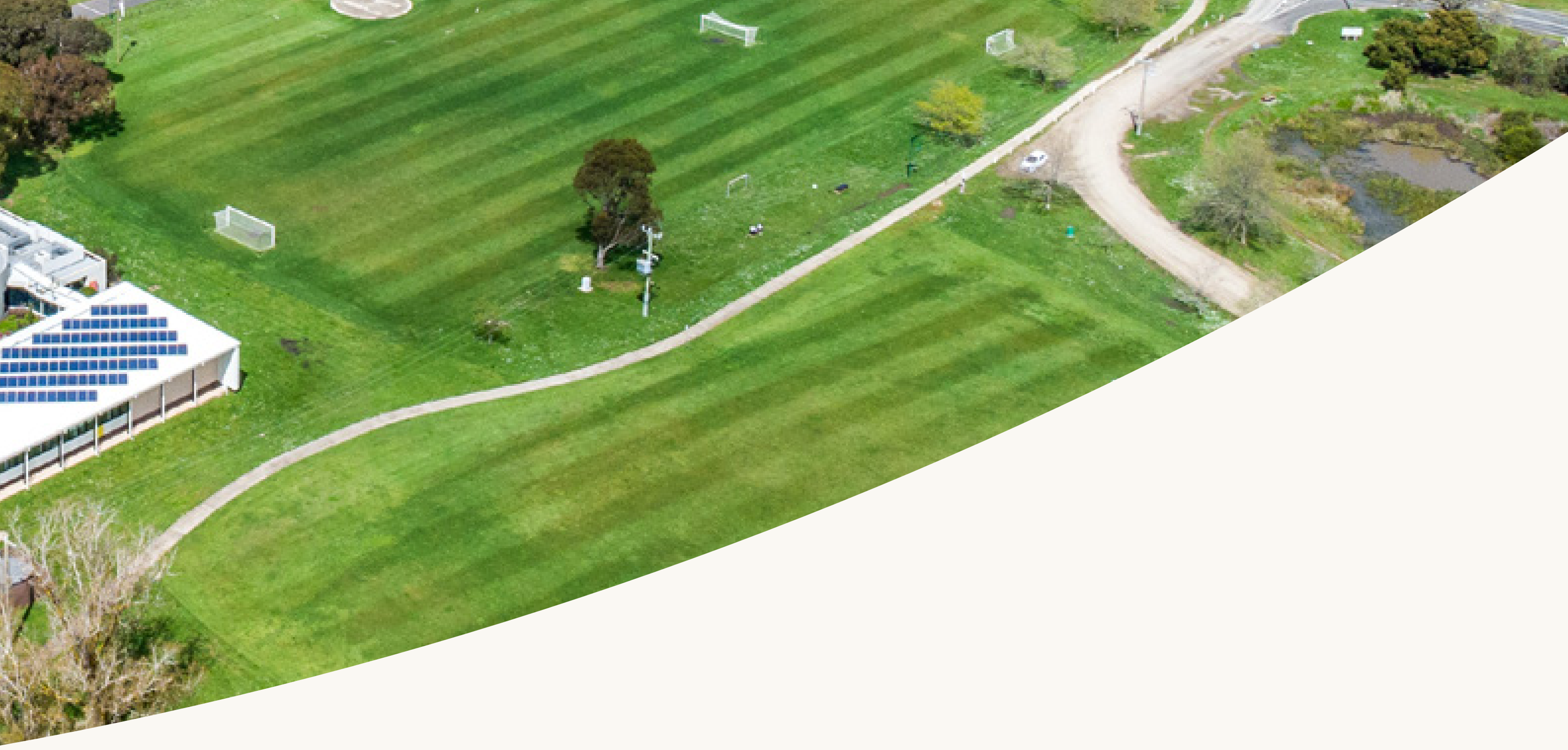
To address the growing risk of severe, prolonged outages, it's essential that infrastructure is developed to support these critical services. It is also vital that local people guide these processes, designing resilience efforts so they meet the needs of the communities they serve and the extreme events they encounter.

Resilient Energy Centres (RECs) offer a practical solution. These are community buildings, such as halls, sports clubs, or neighbourhood centres, that are equipped with backup power systems to provide critical services when the main grid fails.

During outages, people can charge phones, store perishable food in working refrigerators, access the internet, connect with support services, and gather with others facing the same challenges. The solar and battery systems that enable backup power also reduce electricity bills for host organisations, helping community groups remain financially sustainable.

There are various types of resilience that communities need to navigate our changing climate, including social, economic and emotional resilience. For the purpose of this guide, we focus on energy resilience, i.e. how we maintain a reliable and safe energy supply even during shocks, and adapt to changing conditions around us.[5]

1. Queensland Government (2024). Climate Change in Queensland
2. Queensland Fire and Emergency Services (2024). Queensland Critical Infrastructure Disaster Risk Assessment. Queensland Fire and Emergency Services, Brisbane.
3. Queensland Government (2025). Office of the Inspector – General of Emergency Management: 2023-4 Severe Weather Season Review
4. Australian Institute for Disaster Resilience (2018). Community Recovery Handbook
5. International Energy Agency (2022). Climate Resilience for Energy Security



Contributors

RACQ

RACQ is recognised as one of Australia's most trusted member-owned organisations, proudly serving more than 1.7 million Queenslanders. Guided by our purpose - to drive a positive future for all Queenslanders, we embed this commitment across our strategy, operations, and services. From roadside assistance to home, mobility, and solar energy solutions, our team delivers support that makes a meaningful difference every day.

Since 2011, the RACQ Foundation has provided over $16 million in grants to assist more than 500 community groups, charities, sporting clubs, and First Nations Councils impacted by natural disasters.

In response to growing demand, RACQ is increasingly supporting energy resilience solutions to help communities prepare for and recover from extreme weather events. RACQ is committed to working with others to ensure no Queensland community is left behind in the transition to cleaner energy, because every community deserves to share the benefits.

RACQ Solar

RACQ Solar (GEM Energy) are a leading provider of solar and battery storage solutions for homes, small to medium businesses, and large-scale commercial and industrial clients across Australia. With over $300 million in completed projects, they bring proven expertise in solar design, installation, and energy storage.

Their in-house engineers and project managers deliver tailored systems built for performance, reliability, and long-term value.

RACQ Solar is the Delivery Partner for the RACQ Resilient Energy Centre program offering technical advice and support to communities developing their Resilient Energy Centre.

Community Power Agency

Community Power Agency is a not-for-profit organisation with a mission to put community benefit at the heart of Australia's renewable energy shift. Through collaboration, research, capacity-building and advocacy, we share knowledge and support community participation in energy policy and project development.

In 2025, RACQ engaged CPA to co-develop this guide and RACQ's pilot Resilient Energy Centres Program to support Queensland communities to build their energy resilience to climate change.

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Resilient Energy Centre program

Communities across Queensland are increasingly vulnerable to power disruptions caused by disasters and extreme weather events. Resilient Energy Centres address this risk by retrofitting community clubs and charities with solar, battery storage, smart load management and satellite phone and Internet backup. These upgrades ensure facilities can remain operational during grid or telecommunications outages, allowing them to serve as vital hubs for the broader community.

The RACQ Resilient Energy Centre program supports communities to plan, develop and install these upgrades. Through funding assistance, mentoring and technical guidance, the program helps community organisations strengthen their energy resilience and improve their capacity to respond during times of crisis.

Find out more: Visit racq.com.au/REC-program for more information.

Community Power Agency

Understanding RECs

What is a REC?

Resilient Energy Centres (RECs) are buildings with backup power systems to provide electricity during outages. These outages could be due to any number of issues, including natural disasters and extreme weather events.[6]

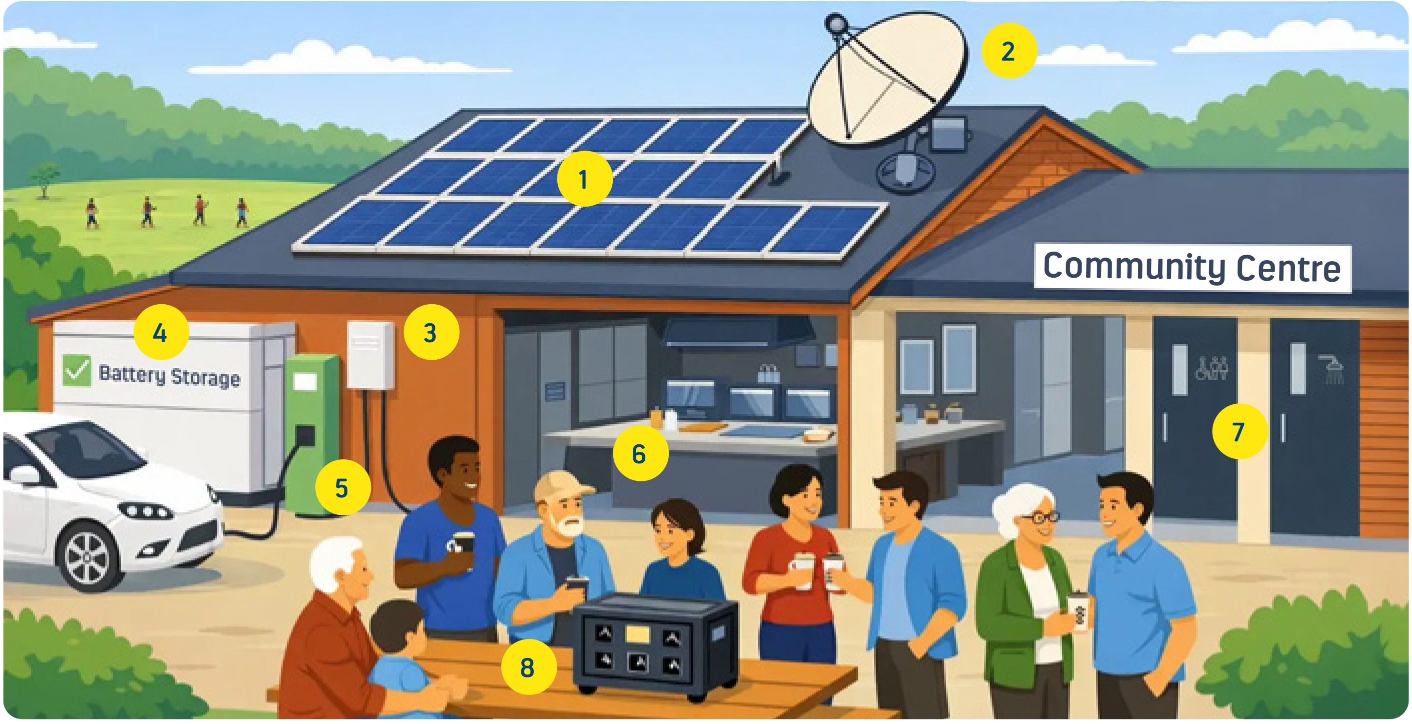


Figure 1: What is a REC?

1	Solar panels	4	Battery storage	7	Toilet/shower amenities
2	Satellite connected internet/comms	5	Electrical vehicle charging	8	Portable batteries
3	Solar inverter	6	Kitchen ammenities		

6. Hancock, N. and Walters, K (2022). Resilient Energy Centres – A How-to Guide (p. 6), Community Power Agency, Sydney.

Why are RECs needed?

Whether it's flooding, storms, droughts, heatwaves, or bushfires, most Queenslanders have lived through a natural disaster. When these natural disasters occur, it's common for houses, streets, neighbourhoods and regions to lose power. This power loss can lead to communication breakdowns, power outages for fuel and payment systems, and, in some instances, present life-threatening risks. Community members that tend to be most affected by power outages include the elderly, people relying on medical or life-support equipment (such as dialysis or ventilators), renters, low- income households, families with young children, as well as people dependent on electrically powered assistive devices, such as people with disabilities.[7] Even if we make our homes self-sufficient, the loss of essential community services affects us all.[8]

This is why RECs are important. As communities face increased disaster risk, having safe places with the power to both plan for and respond to natural disasters will play an increasingly important role in recovery efforts.

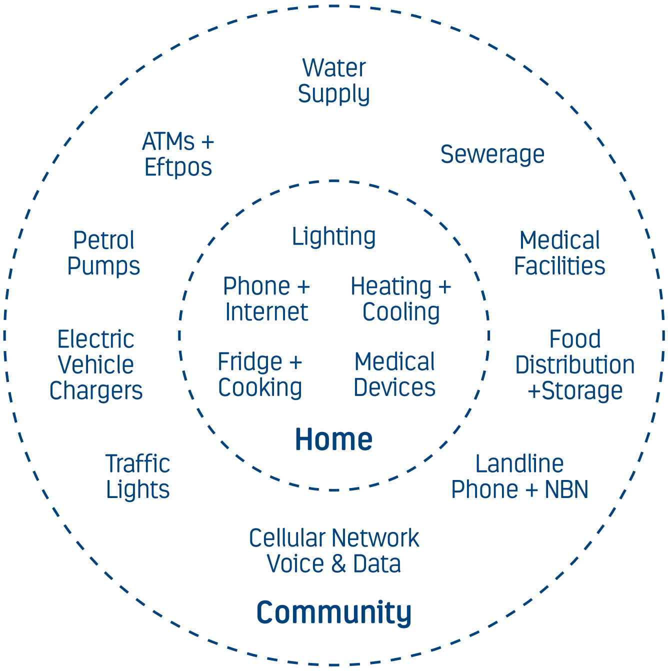


Figure 2: Essential energy services we depend on in our homes, businesses and communities.[8]

Community benefits from a REC

RECs offer benefits to communities in both normal day-to-day operations and during preparation and recovery phases following natural disasters.

During normal operations, they can:[9]

- Help cut facility operating costs
- Act as a base to come together and build community connections
- Be a meeting ground for disaster planning and information sharing

During recovery phases, they can:

- Provide backup power when outages occur for a period of time
- Power telecommunications systems so emergency responses can connect and share information
- Offer power to those without, so they can charge electronic devices like phones
- Store cold food, provide hot water and necessities
- Offer a place to gather or coordinate when the immediate threat has passed

RECs and disaster management in Queensland

Any building can be a REC with the right equipment and purpose. However, not all RECs will be part of formal disaster responses put in place to coordinate actions before, during and after a disaster. This will depend on how the REC integrates with existing disaster management processes. In Queensland, this process is managed by Local Disaster Management Groups, which support local governments in their disaster planning and response.

For community members looking to develop a REC, we strongly encourage you to contact the local council and your Local Disaster Management Group and discuss your plans and the suitability of your facility.

7. Yarra Energy Foundation (2023). Shine a Light: Understanding vulnerability at the intersection of disability and electricity services
8. UTS (2023). Energy Ready Toolkit
9. Hancock, N. and Walters, K (2022). Resilient Energy Centres – A How-to Guide, Community Power Agency, Sydney.

Overview of a REC project

While no two REC projects will be exactly the same, all projects follow broadly the same steps for development and delivery. This guide outlines these steps for a standard REC system.

Phase 1: Developing a REC project idea

- Establish a rough scope
- Identify local hazards and do background research
- Engage with the local community and identify priority needs
- Contact council and Local Disaster Management Groups to share ideas

Phase 2: Site feasibility

- Confirm that the site you have in mind is appropriate, considering community needs, accessibility, emergency readiness, site ownership and potential economic benefits
- Engage with council on heritage, environmental hazards and building soundness
- Seek information on the local network capacity, i.e. the amount of electricity that the distribution network (or grid) can safely and reliably carry at that site
- Review the site's current electrical system and suitability

Phase 3: Technical design and delivery

- Research and seek out qualified and accredited contractors
- Seek quotes and system designs from installers or contractors
- Get training on how to operate and maintain the system from installers

Phase 4: Management and maintenance arrangements

- Finalise management arrangements
- Organise ongoing operations and maintenance responsibilities
- Communicate with the broader community about what the REC does and how it can be used to support resilience
- Review how the REC is working and look for opportunities to improve

Typical timeline: Developing a REC may take between 6-18 months from initial concept to operation.

These timelines depend on a range of factors, including the complexity of the disaster risks you are trying to understand, coordinating with stakeholders and the community, funding availability and timing, processing times to get approval to connect to the grid, timelines for securing hardware and installers, and your organisation's staff or volunteer capacity. We describe many of these factors in more detail throughout the Guide.

Case Study 1

Strengthening community resilience against cyclones

Location: Koah Hall, Mareeba Queensland

Funding

$17,000 (total), $10,000 from the Telstra's Connected Communities Grant Program via the Foundation for Rural and Regional Renewal, $2,000 from Gulf Savannah NRM and $5,000 from the RACQ Foundation.

System elements

- 12.35kW of solar (added to a 3.5kW system)
- 25kWh of battery storage

The Koah Hall in the Mareeba Shire serves as a vital recreation facility. Owned by the Mareeba Shire Council and operated by the Koah Sports and Social Club Inc. Committee, the Hall hosts a range of events and sporting activities, from monthly markets and music gigs, to weekly Pilates and circus classes. The Hall also serves an important function for the community as the Shire's only designated place of refuge during a cyclone.

Cyclones are a common natural hazard in the region and in 2023 the impacts of Cyclone Jasper meant that the local community was without power for over four days. While a backup generator could power the site, the Koah Hall committee members started looking into solar and battery backup systems. For the committee these offered several benefits, including easier operation, reduced electricity bills and lowering emissions.

After receiving funding from several sources, the system was installed and completed in July 2025.

Lessons: As the site is owned by the local council, their early support was essential, with conversations kicking off before the committee started looking for grants. When it came to funding, several sources were needed and flexibility from grant administrators helped the committee to secure adequate funding, requiring some grant acquittal periods to be extended. The committee also benefited from having members with energy industry experience, making it easier to assess quotes and understand the process ahead.

Community outcomes: The hall is the only designated place of refuge during a cyclone in the shire. Now committee members are confident this important site will have sufficient backup power to operate for several days if needed. On top of this, they have gone from paying electricity bills to receiving a monthly credit, which is expected to save well over $3,000 per year. As one committee member noted, "We would need to sell a lot more burgers at the market BBQ to make that much money. This will also improve our financial resilience!."[10].

10. Interview with Koah Hall Committee Member, December 2025.

Developing a REC project

Establishing a rough scope

When planning a REC project, it's helpful to consider your project scope. This should be clear enough to discuss the project idea with others but open to change with community input. Some basic things to consider are:

- Is there a specific geographic area the REC should serve?
- Will the REC be retrofitting into an existing site?
- Are there obvious candidate sites that come to mind?
- What services might the REC provide?

The answers to these questions will become clearer once disaster risks (or environmental hazards) in your local area are identified and engagement with community members begins. Early site feasibility assessments can also inform this thinking, which we describe in Section 4.

Image credit: Community Power Agency

Identifying local disaster risks, priorities and needs

Most Queenslanders have lived through a flood, bushfire, storm, heatwave or drought. These hazards may affect different communities and their residents in very different ways. Looking to understand which hazards might impact your community can be a helpful way to start refining the project's scope and ensure that your REC responds to real risks and conditions on the ground. A good place to start is to learn about past natural disasters in the area, their impacts, and the people and places affected.[11]

For example:

- Knowing about existing social networks, community organisations, informal support systems and resources available, can help you identify resilience efforts already underway, who is most at risk, which groups can champion the project, and how information and support circulate during disaster events.
- Understanding past experiences from emergency services and responders[16], can improve your understanding of who is in need and what essential services the REC could provide to meet those needs.
- Considering changes in your environment, infrastructure, demographics or climate might provide greater clarity on future disaster risks your community faces. For example, new developments in low-lying areas may be increasingly prone to flooding in the future. There are also many regions with growing populations of older residents who, without adequate cooling, may be more vulnerable to heatwaves.

Together this information can help identify potential REC sites or facilities and the useful services people might need to ensure it's fit-for-purpose. Engaging with your community to answer these questions will help you build relationships that make it easier to respond when natural disasters occur.

Toolbox 1: What information is available to inform my scope?

Here are some resources that can help inform your project scope, providing data and information on local people and risks, as well as common plans and dashboards used to manage natural disaster responses.

- **Demographic or economic data tools:** such as the Foundation for Rural and Regional Renewal's *Community Data Tool.*[12]
- **Climate risk maps:** such as the Climate Council Climate Risk Map[13] as well as specific state and council risk maps.
- **Council disaster response management plans:** such as this example from the Bundaberg Regional Council.[14]
- **Disaster dashboards or panels:** see the Mount Isa Disaster Dashboard for an example.[15]
- **Local Disaster Management Groups:** often hold lists of critical infrastructure vulnerabilities, post-event outage impact summaries and local network reliability issues raised by emergency services. These are not public maps but can be requested.

11. For further advice on community engagement for disaster resilience, see: AIDR (2020). Community Engagement for Disaster Resilience Handbook
12. Foundation for Rural and Regional Renewal. FRRR Community Data Tool
13. Climate Council. Climate Council Risk Map
14. Bundaberg Regional Council (2025). Local Disaster Management Plan
15. Mount Isa Disaster Dashboard
16. AIDR (2020). Community Engagement for Disaster Resilience Handbook

Engaging with the community and other stakeholders

Engaging with the community is essential to planning your REC project and making sure it addresses local needs. Engagement can also help understand resilience efforts already underway and build relationships that make it easier to respond when natural disasters occur.

In community engagement, all people should be treated with respect, appropriate opportunities to engage should be offered, mutual benefits should be considered, input should be listened to and responded to, and transparency should be fostered.

Toolbox 2: What does good engagement involve?

Here are some common principles of good community engagement.

- Bringing people along the development journey
- Being good listeners and seeking to learn
- Aiming for more participatory engagement where suitable
- Communicating consistently and keeping people in the loop
- Reaching diverse community members by considering their communication preferences and needs

Planning engagement with local people

Having an engagement plan can help keep this process smooth and well considered. This plan should identify who might be contacted, how they will be reached, and what questions or decisions their input will be sought on. For example, an engagement plan can help you keep track of whether you are across the needs of different vulnerable groups in the community, or have reached out to site owners to gauge their interest in converting their sites to RECs.

Particular stakeholders to consider engaging with include:

- Site owners or site managers
- Community organisations or groups
- Local resilience, energy or sustainability organisations
- First Nations organisations
- Council staff
- Local Disaster Management Groups
- Emergency service providers (SES, fire authorities)

Different people and groups will have different preferences around how much and in what ways they engage in the project. A survey might suit community members with less time and a little interest in the project. For those who are more engaged, a workshop or small meeting may be suitable.

It's wise to consider how communication will continue throughout the project to connect with local community members. For example, creating Facebook or Instagram posts, or including updates in an online or physical newsletter.

The staging and sequencing of activities should also be planned. For instance, if talking to community members about a specific site, the site owner should be aware and supportive of the project.

Council and Local Disaster Management Groups

Councils and Local Disaster Management Groups can provide helpful insights for engagement and the REC project more broadly.

Your local council is responsible for disaster management responses and may have a lot of information on disaster and environmental planning, as well as potential REC sites.

In particular, Local Disaster Management Groups, established by council, bring together different groups and services involved in response efforts and may be interested in community plans to progress a REC.[17]

Council often has a lot of insight that can help with planning REC projects, ranging from community engagement, to planning, local hazard risks, disaster response and existing resilience initiatives. Because of this, they are an excellent resource for understanding site feasibility and, in some instances, identifying potential sites. Reaching out for a call or meeting early on is ideal.


Image credit: Anna Meltzer

Identifying priority services and functionality

Some RECs power fewer services during outages to save energy and keep these systems running longer. Your engagement efforts can help clarify community needs and priorities for the REC to support.

Some needs in your community could include: the ability to communicate during a disaster, access to basic power for device charging, access to clean drinking water, access to washing for food preparation, or cool storage to avoid food spoilage. In some communities, cooling during heatwaves or ventilation during bushfires may be key.

Understanding these needs can help you identify the services your REC might prioritise.

Key services that may be included:

- Basic lighting
- Power sockets for phone and device charging
- Communications equipment like radios or internet modems
- Refrigeration
- Water pumps

Other services to consider:

- Cooling and/or heating
- Air purification
- Medical devices

Tip: Down the track there may need to be trade-offs in what is and isn't powered when the REC is operational. To make these decisions easier, look to establish community needs in order of priority.

Toolbox 3: What survey questions should we ask?

Community surveys are a great way to establish community priorities and needs. Below are some survey questions that can help to refine your project scope with community input.

- Do you have backup power where you live?
- In past natural disasters or outages, have you gone to other places for amenities and services, power, or safety and support? If so, why?
- If you were to travel to a powered community facility during a power outage, how would you get there?
- Are you aware of specific groups of people in the area who struggle during outages? If so, which groups and what struggles do they face?
- How do you normally receive information during natural disasters or emergencies?
- During a natural disaster, what do you think you'd need most urgently? Please rank the following:
  - Charging phones/devices
  - Access to Wi-Fi or telecommunications
  - Lighting
  - Medical equipment that requires power
  - Refrigeration for food or medication
  - Hot water
  - A cool/warm place to stay
  - Shower facilities
  - A safe place for children or older relatives
  - Other

17 Queensland Government (2024). Evacuation: Responsibilities, Arrangements and Management Manual

Building Resilience: How St Albans Hall became an emergency communication hub for residents

St Albans Hall, Hawkesbury NSW

Funding

$500,000 across the Stronger Communities and Black Summer bushfire grants

System elements

- 13.2kW PV
- 12kWh battery (upgrade pending)
- Backup generator
- Satellite NBN
- Fire protection upgrades incl. sprinklers
- Reverse cycle A/C

The St Albans Community Hall in the Hawkesbury is owned by the regional council, but being a remote location, is largely operated by a local association who pays for electricity out of hall hire fees, with major works provided by council. The hilly nature of the Hawkesbury region means that the community around St Albans Hall have to deal with roads that are slow and windy, and there are many phone and radio dead zones. The result is that there are few places to find good information during an emergency, and in 2019 many of the residents were forced to go to the local Rural Fire Service (RFS) sheds to try and get up-to-date news. This posed a risk to both residents and the RFS crew, who were trying to respond to the growing threat of fire.

Following this event, the community realised they needed a location to gather and receive emergency briefings that would not be in the way of the emergency response activities.

The hall is also used by local clubs and rented to people outside the region for special events, so the upgrades chosen were intended not only to fulfil community needs in an emergency but also to make the hall more usable and cost-effective to operate on a day-to-day basis.

Lessons: Communication between council and the community group is the key to success. When communication broke down, delays were common, and overlap in grant applications led to inefficient spending. Once a project manager in the council was assigned to the project, coordination improved considerably.

Community outcomes: During an emergency, they plan to use the hall as an information point for local residents to check in and coordinate. They also intend to use energy bill savings to reduce hall hire costs for local groups.

Checklist 1: Developing a REC project

The following checklist summarises key actions you might consider when developing a REC project.

- ☐ Have you identified current and future hazards for your community?
- ☐ Have you reached out to Council and Local Disaster Management Groups to let them know about your project?
- ☐ Have you planned how you'll engage with your community?
- ☐ Have you considered who is most vulnerable in your community?
- ☐ Have you thought about who needs access to a powered community facility in an outage?
- ☐ Have you considered how people will use and reach the REC? I.e. transport, disability access and language needs.
- ☐ Have you established priority services and functionality for a REC based on local needs?

Site feasibility

What makes a good REC site?

You may have a clear site in mind - especially if you're part of an organisation that owns and manages a community facility. Or you may want to consider whether a site is suitable for a REC project. There are a range of factors that are good to consider as you start planning, including: who owns and manages the site, if the site is accessible and familiar to the community, does it already serve an emergency function and, if it might offer wider benefits to the community.

Lots of different buildings may be appropriate sites for a REC for example, local sports clubs, community halls, men's sheds, or neighbourhood centres. Perhaps it's a council facility or a site already used for evacuation or disaster response.

It's helpful to do some research and consider if your site, or other sites in your local area align with community needs and priorities.

Some common sites to consider:

- Community halls
- Sports clubs
- Recreation facilities
- Neighbourhood centres
- Church halls or places of worship
- Showgrounds
- Scout or guide halls
- Men's sheds or community workshops
- Rural fire brigade stations (if not used during fires)
- Community libraries
- Senior citizens centres
- Childcare centres or preschools

Toolbox 4: Evacuation facilities and safer locations

Evacuation facilities and safer locations have very distinctive meanings in a Queensland context. Evacuation facilities accommodate people during disasters, including evacuation centres, cyclone shelters and places of refuge. Whereas safer locations are places that are not expected to be impacted by a hazard, and could include sheltering 'in place', staying with friends or family, neighbourhood safer places and assembly points.[18]

Some evacuation facilities are designed for a specific purpose (including all cyclone shelters). At the same time, others may be appointed based on the situation or event.

Importantly, while having backup power at a community facility might make it more resilient, council and local Disaster Management Groups will be responsible for assessing whether it could be used as an evacuation facility or a safer location, so early contact with these groups is ideal.

18. Queensland Government (2024). Interim Queensland Prevention, Preparedness, Response and Recovery Disaster Management Guideline 2024-25

Site considerations

Here are a few key considerations to start with when assessing a site's feasibility.

Site ownership and managers

It's easier to retrofit a REC when you own and operate that site, or have a long-term lease. Councils and state governments own many community buildings, recreation facilities and sports club buildings, which are often managed by other organisations or committees. Site managers need approval to initiate a REC project, typically by starting with a letter of support and, if applicable, updated lease terms. When you're not the site owner or manager and you can't get them on board with the project, you should look for an alternative site.

Accessibility and familiarity

Places already used by the community are ideal. This is because trust and familiarity are essential in a crisis scenario. Regular use may also reflect that those involved in managing the site are responsive to community needs.

Emergency readiness

In some cases, facilities may already be set aside for emergency use. It's worth considering if the site is likely to be accessible in a disaster, for instance, if connecting roads are prone to flooding. These may also be places made for emergency responses, such as dedicated evacuation centres, cyclone shelters or places of refuge, that could be retrofitted with REC systems.

Non-energy resilience benefits

Some sites may be more likely to offer benefits beyond energy resilience. These can include shade, heat refuge and specific services, such as showers or cold storage.

For example, a community sports centre with high energy use late in the day could save on bills by making the most of cheap solar energy stored in batteries. Another example is a business with ample refrigeration capacity, where backup power during outages could prevent costly food spoilage. For this to be a REC, some of that refrigeration capacity could be shared with the community.

Assessing potential sites

Once you've established one or more potential sites, you can further refine your site selection by identifying any clear no-go areas based on environmental hazards, heritage, building soundness, electrical systems, and network capacity.

Fortunately, there are many sources of information and skilled people who can help assess sites. For heritage, environmental hazards and building assessment considerations, council planning teams have lots of information. Below are some tips and tools that may be useful when addressing these.

Heritage

In Queensland, many buildings have specific heritage protections overseen by local councils.[19] These protections may require in-depth development assessment and approval processes for projects that make changes to buildings, such as adding solar, changing wiring, or installing other fixtures. In some instances, exemptions can be obtained from council[20] – but when there are many conditions, this can make REC projects trickier and sometimes more costly to deliver.

When looking for more information, council planning scheme provisions describe how they manage heritage. It might also be wise to look at their local heritage registry, as well as the Queensland heritage register.[21]

Environmental hazards

A range of environmental hazards can affect the feasibility of a REC site. Ideally, you're looking for sites less exposed to environmental hazards that could pose a risk to your community. While most of these hazards can be managed, they may add to project costs.

- In high-wind regions, solar systems may require reinforced mounting systems.
- In bushfire-prone areas, fire authorities can help establish safe locations to house batteries or generators and assess whether additional casings are required.
- In flood-prone areas, you'll want to consider if the site is above or below historical flood levels. Batteries or generators should be located above likely flood heights and may require plinths.
- In coastal areas, it's worth considering corrosion and ensuring fixtures and fittings are resistant.

Toolbox 5: What is the Bushfire Attack Level (BAL)?

If you have identified bushfire as a potential hazard, it is recommended that you have your site assessed for a BAL, with a fire safety assessor or local fire authority. This will ensure that your REC is located somewhere that will likely be standing when it is needed after the immediate danger of bushfire has passed.

Building soundness and suitability

Finding suitable buildings or facilities is essential for your REC to serve community recovery needs in a natural disaster. Different environmental hazards will have different impacts on what might be a suitable site. For instance, in high-wind regions (C&D), a structural assessment may be needed to determine whether the building is sound enough for solar panel installation.

In general, it's good to consider the age and condition of the building, looking for signs of rust or damage that could pose risks to the facility or require costly changes later down the track.

Where solar is being installed, consider building orientation and if panels are likely to be shaded during the day, because this would reduce the system's overall efficiency.

Network capacity constraints

Different sites may be more or less able to connect and export to the local grid. This is because some areas have so much solar that network operators have imposed constraints on new solar systems. In many remote areas, the local network often has limited capacity to host solar installations and is prone to voltage fluctuations that complicate grid connection and approval.

Speaking with a qualified installer can help you find out if your local network is constrained and if there are feasible workarounds. These solutions could include dynamic connections that can ratchet down solar exports based on local network needs, or systems that limit exports entirely (known as zero export limits).

19. Queensland Government. Heritage conservation in Queensland
20. Brisbane City Council (2023). General Exemption Certificate: Local heritage places
21. Queensland Government. Queensland Heritage Register

Toolbox 6: What do network connection processes involve?

Queensland's energy infrastructure is governed by Australia's largest Government owned electricity company, Energy Queensland. Depending on where in Queensland you are located your network application will be lodged with either the Energex or Ergon.

To understand what is involved in network connection at your site:

- Familiarise yourself with the connection application process for your local network, either Ergon[22] or Energex.[23,24]
- Check the network capacity for solar connections at your site via the Energex and Ergon Network Load & Export Capacity Map.[25]
- Work with an accredited installer to determine the network capacity feasible at your site, your network requirements, and what this means for your REC project.

Questions you can ask your installer include:

- Is the site on single-phase or three-phase?
- What is the maximum inverter size and export limit allowed at this site?
- Will dynamic export limits apply?
- Are any upgrades required, and who will pay?
- If more complex connection processes are required, including network connection studies, consider reaching out to consultancies with experience in similar projects, if your budget allows.

22. Ergon Energy. How to Connect
23. Solar Nerds. Energex Solar Connection Process
24. Energex. Solar Connections and Other Technologies
25. Energex and Ergon. Network Load & Export Capacity Map

Electrical system

It's helpful to understand the existing electrical system at the site you're looking at. This information can help inform your early conversations with installers and other technical trades or consultants.

Key things to look out for include:

- The available capacity of the switchboard.
- Whether the facility has single-phase, two-phase or three-phase power, which affects battery sizing and connection options.
- If solar panels are already installed and their capacity (kW).
- Where solar is installed, the type of inverter that is used.
- If the site is part of an embedded network.

Toolbox 7: What are embedded networks?

Embedded networks are private electricity networks that service several premises or dwellings. Some common examples include many shopping centres, apartment blocks, and caravan parks.

Embedded Network Managers or Operators manage the embedded network and typically purchase bulk energy from a retailer, which then on-sells to people, businesses, or organisations occupying different premises. These different premises at the site will have their own separate meter.

While there may be no technical constraints on installing a REC in an embedded network, the Embedded Network Operator or the Embedded Network Manager may need to grant permission for the system.

Fire stations backup for community resilience

Location: CFA Bogong, Indigo Shire Victoria

Funding

$500,000 from the Federal Government's Black Summer Bushfire Recovery Grants program

System elements across 15 projects:

- ~7kW per site, 108kW in total
- ~6-10kWh battery storage per site

The Victorian Country Fire Authority (CFA) Bogong Group saw an opportunity to install solar and battery backup after the 2019-20 Black Summer bushfires. With fire stations playing a critical role in emergency responses, the Bogong Group saw backup as essential to supporting their response efforts and community recovery.

In partnership with Indigo Shire Council, they applied to the Federal Government's Black Summer Bushfire Recovery Grant program. This funded the installation of solar and batteries at 15 fire stations across the north east of Victoria.

Importantly, these fire stations will not only support CFA activities but also offer communities a place to recharge their battery-powered devices during blackouts.

Lessons: The project involved collaboration between the council and the CFA to secure funding. The fire stations also presented their own challenges, being metal sheds with a greater risk of electrocution should circuits be damaged. To avoid this risk, they installed optimisers and protection systems to enable rapid shutdown if needed.

Community outcomes: The solar and battery systems are expected to offer community members a safe place to charge devices if needed. The CFA also expect to have financial savings from day-to-day operations.

Checklist 2: Site feasibility

Some questions to consider during site assessment include:

- ☐ Is the proposed site accessible and familiar to community members?
- ☐ Is the proposed site likely to provide emergency benefits to the community?
- ☐ Are the site owners, operators, and/or managers on board with the project?
- ☐ Does the proposed site offer non-energy resilience benefits, such as potential savings or other potential co-benefits?
- ☐ Has the council advised on heritage, environmental hazards and local building requirements (if relevant)?
- ☐ Is there sufficient local network capacity to install a REC?
- ☐ Is the site's electrical system and appliances suitable for retrofitting for a REC?

Technical design and delivery

Working with installers and technical service providers

Once a suitable site for the REC has been identified, the next step is to engage qualified installers and technical consultants to help design the system to meet community needs. When selecting installers, prioritise those with a strong local reputation, excellent communication skills to inform those involved throughout the process, and proper accreditation and experience in delivering backup projects. It is helpful to get multiple quotes to compare and negotiate terms.

While many experienced installers can lead the way in designing and coordinating most REC projects, in some instances consultants may be needed - for example, if a project has complex network connection requirements or is backing up a large commercial facility.

However, while most installers will complete design work for free as part of their initial quote, consultancy services incur a cost. These costs can be high. For instance, feasibility studies may cost well over $10,000.

If the REC project requires these technical consultants, it's worth considering whether the budget is available, whether the expense is justified, and whether a different solution could still address local needs.

Readers tip: This guide doesn't cover microgrids or Stand-Alone Power Systems (SAPS). For more information on microgrids, see the Australian Government Energy Innovation Toolkit.[26]

Toolbox 8: What is the emergency backstop mechanism?

The emergency backstop mechanism has been introduced across all states and territories and may be worth considering and discussing with installers. This mechanism is designed to help protect the grid by turning off solar when system security is at risk.

To comply with the emergency backstop mechanism, new inverters over 10kVA, or those replacing existing inverters, need to include a generation signaling device. This device enables communication between network operators and these inverters, so exports to the local grid can be controlled.[27] Networks have noted that these events are very uncommon.

When installing a new solar system or upgrading existing inverters to enable backup supply, ensure the system proposed is compatible.

What to look for when selecting an installer

When selecting an installer for a REC project, it's essential to check that they are appropriately qualified and accredited. This is particularly important not only for the reliability and quality of the REC system but also for accessing government subsidised programs, as many require accreditation, qualifications, and adherence to specific regulations and requirements.

- All solar and battery products must be on the approved list of the Clean Energy Council (CEC) to be eligible to produce Small Scale Technology Certificates.[28]
- Installers must hold at least Install Only SAA (Solar Accreditation Australia) accreditation for Grid Connected Solar and Battery Systems.
- Electrical Engineers designing the system must be an RPEQ (Registered Professional Engineer of Queensland) and must hold at least Design Only SAA Accreditation[29] for Grid Connected Solar and Battery Systems.
- Electricians must hold a current Queensland electrical contractor licence.
- All trades should have public liability insurance and workers' compensation insurance.

To verify credentials, check the SAA installer's online register. The Approved Sellers list from the New Energy Tech Consumer Code is another valuable resource; however, there are fewer suppliers listed here than on the broader market.[30] In addition, consider requesting copies of licences and insurance certificates, and asking for references from similar projects.

26. Australian Government. Australian Government Energy Innovation Toolkit: Microgrids
27. Queensland Government. Emergency Backstop Mechanism
28. Australian Government. Small-Scale Technology Certificates
29. Solar Accreditation Australia. Check Installer Accreditation Status
30. NETCC. About the New Energy Tech Consumer Code program

Getting quality quotes and proposals

Once accredited installers have been established, quotes can be requested based on the identified scope and community priorities. It's vital that the installer understands these priorities and can communicate how the proposed system will achieve some, if not all, of them.

Quotes should include:

- Complete equipment specifications with make, model and warranty details for all components.
- Installation scope covering labour and timelines.
- Site-specific installation designs. For instance, a site layout showing the solar roof design and panel placement, generator placement, a battery storage placement with a single-line diagram that explains the system key components, and how they work together.
- Electrical calculations including site voltage rise with the new system.
- An overview of the network connection process and timelines.
- Compliance requirements, permits and standards certification (AS/NZS 4777, 5033, 5139).
- Clear exclusions stating what's not included and any potential additional costs.
- Payment processes, terms and conditions.

Toolbox 9: What solar subsidies are available?

The Federal Government has now included some batteries in their Small-Scale Renewable Energy Certificate program. These subsidies are available for batteries with a nominal capacity of 5kWh to 100kWh. However, only 50kWh of usable energy is eligible for the subsidy. In short, something larger can be purchased but only a portion of the battery will be subsidised.[31]

To be eligible for SSRECs, systems must meet the criteria listed above and be Virtual Power Plant-ready. This means that the battery and inverter system could connect to a VPP in the future.

31. Australian Government. Small-scale Renewable Energy Scheme

Virtual Power Plant (VPPs) and your solar battery system

Modern battery systems (often called Battery Energy Storage Systems or BESS) are now commonly "VPP-ready." This means they can be connected to a Virtual Power Plant and remotely monitored and managed using secure software.

A Virtual Power Plant (VPP) is a network of many small energy systems (like solar panels and batteries) that are linked together and operated as if they were one large power station*.

VPPs help stabilise the electricity grid by:

- Absorbing excess solar energy when there is too much supply (for example, in the middle of the day).
- Supplying energy when demand is high or supply is low (for example, in the evening).
- Helping maintain grid stability by supporting frequency control (often referred to as FCAS – Frequency Control Ancillary Services).

By doing this, VPPs can create additional revenue streams for community energy projects.

How does a VPP work?

When your solar-battery system joins a VPP program:

- A specialist company (called a VPP aggregator) connects your system to a secure digital platform.
- The platform can monitor and control when your battery charges, discharges, or exports electricity to the grid.
- The battery is used at times that best support the wider electricity system.
- In return, the site or community may receive bill savings or payments.

Importantly, your system's primary role – powering a Resilient Energy Centre (REC) during outages or community events – should always come first. The VPP should only use the battery when it is not needed for essential local services.

What does a VPP aggregator do?

The VPP aggregator helps the solar battery system participate effectively in the market while respecting the agreed priorities of the site (such as keeping reserve capacity for emergencies). It manages administration and contracts, trades electricity into energy markets, optimises when the battery charges and discharges, and ensures the system follows agreed operating rules.

Questions to ask your delivery partner

Before joining a VPP, communities should ask:

- Will we be able to monitor and control the system to make sure it meets community needs first when it counts?
- How do you guarantee that emergency backup and major events are always prioritised over VPP revenue, especially in advance of extreme weather?
- Are there clear operating protocols for extreme weather events to ensure we have minimum battery reserve when we are likely to need it?
- Can the battery forecast weather and solar output to make sure community needs are protected?
- During a grid outage, does the VPP automatically disconnect?
- Can we override the VPP if needed (for example, during a heatwave, tournament, or emergency)?
- What happens if the VPP dispatch leaves us short of power?
- Does the platform provide regular, easy-to-understand performance reports?
- Is there any penalty if we withdraw from the VPP temporarily?
- Who makes decisions about participation thresholds?
- Is there a clear dispute resolution process?
- What income can we expect from a solar-battery system at our site?
- Has the system been designed so it can connect to a VPP now or in the future?
- Does the site's export limit (how much electricity it can send to the grid) affect whether VPP participation is financially worthwhile?
- Can the battery participate in all relevant grid support markets (including frequency control services)?
- How are payments calculated?
- What is the likely annual income range?
- What could reduce or stop payments?
- Are there fees or revenue sharing arrangements?
- What are we committing to?
- Will joining a VPP change our existing electricity retail contract?
- How long is the contract?
- Are there exit fees?
- Can we change aggregators later?
- What happens if the aggregator company fails?
- Will this affect our future plans?
- Will the VPP increase battery wear?
- Does it affect the warranty?
- Is the battery technically or contractually restricted so that it can only work with one specific VPP aggregator?

*Clean Energy Regulator, Virtual Power Plants, 30 June 2025.

Sample Case

How a local sporting club turned energy costs into savings

A local sporting club wanted to get control of its rising power bills. Like many community clubs, it relied heavily on electricity for lighting, refrigeration and daily activities. Its yearly power costs had grown to about $47,800, putting pressure on the club's budget.

To take back control, the club partnered with an accredited installer to install a solar system and battery.

The goal was simple:

- make their own power,
- use less from the grid, and
- lower their electricity bills.

The new system lets the club create its own solar energy during the day and store extra power in a battery for later use. The club also joined a Virtual Power Plant, which is a program that pays them for helping support the electricity network when it needs extra energy.

The results

The impact has been significant:

- Electricity costs dropped from about $47,800 to $16,500 per year saving around $31,000 annually.
- The system earns around $29,000 each year through energy programs and selling power back to the grid.
- Total financial benefit: about $60,000 every year.

After rebates, the club invested $142,442 in the system, and it is expected to pay for itself in just 4.4 years.

With these savings, the club can now redirect money back into facilities, programs and community activities. This case shows how solar and batteries with a VPP can help community groups reduce costs and create new income, without needing deep technical knowledge about energy.

Toolbox 10: What to ask installers?

To help you select between different quotes, have a conversation with these installers. Some questions to help compare installers and their solutions are listed below:

- **Backup capability**: How does the system provide backup power during grid failures? Which circuits will be backed up?
- **Equipment:** Why was this specific equipment recommended? Is it on the CEC-approved products list and suitable for Queensland's climate? Is my inverter suitable to meet the emergency backstop requirements?
- **Installation:** Who will do the work? Are they qualified to do this work?
- **Appropriateness:** What protections for cyclones, bushfires or floods are included? Is weatherproof cabling needed or corrosion-resistant hardware?
- **Ongoing support:** What training, monitoring and maintenance support is provided once installation is complete? What kind of relationship do you have with suppliers? What are the best contact numbers and emails if any issues arise? What are the terms of the warranty should any products fail? etc.

Components and systems

Generally there are four categories of equipment that a REC will be looking to install:

1. Generation equipment: provide power to the REC, including solar, batteries, and LPG or diesel generators.
2. Demand equipment: are the appliances and systems that use power, also referred to as 'load'. In designing a system, the relationship between these two factors will be dynamic.
3. Inverters and control equipment: these systems manage and control your generation and in some cases, site loads to ensure your backup system operates as intended.
4. Backup communications: Because communications often fail during major events, RECs sometimes incorporate backup options, such as satellite or radio communication devices.

Budget often plays a big role in the size (or capacity) of generation equipment and how much demand (or load) the REC system can support. The level of demand at the site will also influence how much generation is needed. Knowing what generation capacity a system has and the site's energy demand is essential to designing a robust system.

Toolbox 11: How can the site load and system size be estimated?

If you'd like to have a more informed conversation with your installer, you may consider doing some of your own load calculations. This can help you understand how much load you'll need to power during an outage, which can inform the size of the battery and solar array you might need.

First, you'll want to check the power rating of the appliances your system will back up. This continuous power rating is measured in Watts (W) or Kilowatts (kW). Most devices will have a power rating on device labels, or you can do a quick internet search to check. You'll then need to estimate how long that appliance is used over the course of a given period.

Energy use for that appliance over that timeframe = Continuous Power rating (kW) x Time (h)

You can then use this calculation for other appliances you want to back up and add them together to get a basic sense of your energy needs over a given period.

It's important to be aware that some appliances have a significant 'surge power' – for instance, water pumps, air conditioning or fridges. The maximum surge power should be serviceable from your intended solar, battery and/or generator mix, and your battery should be able to store the energy needed for that period.

Your solar, battery inverter, or generator should be able to meet the total power needs of the appliances you're backing up. The total electrical energy needed (in kWh) determines the size of the battery needed.[32]

32. UNSW Sydney (2023). Guide to backup power options for resilient households

Generation and storage

There are various technologies for generating and storing energy. Here, we briefly discuss their use cases, potential issues or limitations, and considerations for each technology type.

Solar PV

System overview: Solar PV is the most affordable renewable generation technology for households and community facilities.

Quality: Solar panels have a tier rating system; however, this actually applies to the manufacturer, not the panels themselves. While they might provide some information, the most important thing is to ensure they come with a good warranty and that the panels themselves are CEC-accredited. Ensure your installer maintains solid supplier relationships to honour warranty claims.

Best applications: Solar is ideal for RECs because it provides a simple, low-cost power source that requires no fuel inputs – only sunlight. It can complement other backup systems, like generators and batteries. They also have the added advantage of potentially helping sites to reduce energy bills during regular operation.

Limitations: If you're in an area affected by a natural disaster with significant smoke or cloud cover, this would reduce the solar system's output, potentially leaving you without power sooner. If you are in an area exposed to hazards such as cyclones or significant storms, or bushfire risk, this should be a consideration.

Installation factors: Panel orientation and angle relative to the sun affect output. Optimal angles vary by Queensland location:

- **Brisbane and South-East Queensland:** approximately 27 degrees
- **Central Queensland (Rockhampton area):** approximately 23 degrees
- **North Queensland (Townsville area):** approximately 19 degrees
- **Far North Queensland (Cairns area):** approximately 17 degrees

Generally, angles closer to your location's latitude perform best. However, experienced installers can design effective systems for various orientations based on specific site requirements.

Battery storage systems

Technology details: Lithium-ion batteries are increasingly common for solar storage, with Lithium iron phosphate (LiFePO4) batteries becoming popular for their safety profile and longevity. Systems typically have warranties of 5-10 years, depending on the manufacturer and battery chemistry. Warranties usually cover approximately 20% capacity reduction over the warranty period, though batteries remain functional beyond this timeframe.

Batteries feature two key specifications:

- **Storage capacity:** (kilowatt-hours, kWh): total energy available
- **Maximum output:** (kilowatts, kW): instantaneous power delivery capacity

A 5 kWh battery can supply a total of 5 kWh of energy, for example 1 kW for about five hours or 5 kW for about one hour, depending on its maximum discharge power rating.

Quality factors: It's important to ensure that battery products are CEC-listed. Good installer-supplier relationships help address warranty claim issues that may arise.

Optimal uses: Batteries store power for later use and usually cycle daily – charging during the day from local solar or imported electricity, discharging in the evenings when solar capacity isn't available. They can be used with solar to provide backup power, and generators can be added for longer-duration backup solutions.

Challenges: Batteries can be costly; however, prices are dropping thanks to government incentives and subsidies. Proper ventilation and cooling are essential, particularly if placed within an existing building. There are also standard requirements on exact placement and avoiding locations near commonly used rooms. In coastal areas, consider corrosion and installing protective enclosures.

Design considerations: Many issues can arise if installers do not understand the purpose and use of the battery system. It's wise to communicate this purpose to installers, for instance:

- Response time requirements – this may be very important if the site is backing up medical or life support equipment
- Daily usage patterns and charging cycle preferences
- Integration with generators and/or existing solar systems
- Mobility requirements (some systems offer portable designs)
- Climate and environmental hazards to consider for your location

LPG generators

System description: LPG (or 'natural gas') generators come in various capacities. They tend to work best when providing a steady rate or flow of power below their maximum capacity. For instance, a 10kVA generator may perform better at 6kW with continuous use but struggle with demand spikes. Units typically include integrated inverters and can connect directly to building electrical systems. Integration with solar or battery systems usually requires advanced control or inverter systems.

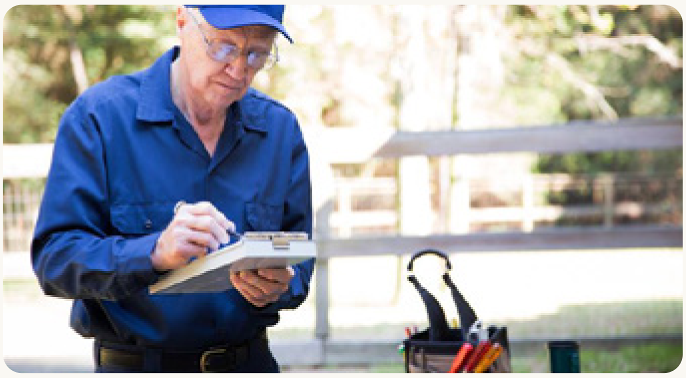
Applications: Generators provide on-demand, extended-duration power generation, which can supplement other sources. This is particularly useful if the sun goes down, smoke cover, or storm clouds present an issue.

Potential issues: Regular maintenance and fuel costs are common for LPG (and diesel) generators. LPG is highly flammable and requires proper handling and storage. An external gas bottle may present bushfire and cyclone risks in some locations. In cyclone-prone areas, ensure gas bottles and generators are properly secured to prevent damage from high winds.

Diesel and biodiesel generators

When to use: If the generator will be used more often, it might be appropriate to consider diesel generators.

Maintenance requirements: Diesel fuel degrades during extended storage, requiring both regular generator operation and fuel replacement – usually multiple times over a year. Queensland's warm, humid climate can accelerate fuel degradation, so regular fuel management is particularly important. Diesel units offer higher capacity options than other generator types. They require proper maintenance for ongoing reliability, which can be costly.



Inverters and advanced control

Inverters are the backbone of any solar and battery system. Increasingly, inverters are integrated into battery systems, and new innovative functions are coming online. More sophisticated systems can incorporate demand management and smart controls to support more complex operations. We've described some considerations for inverters and control systems below:

Basic solar inverters

Solar inverters make power usable for your community needs. They do this by converting the direct current (DC) electricity that is generated by solar panels into alternating current (AC), which is what powers your appliances. However, batteries charge and discharge DC power. There are two key ways to integrate a battery with an existing solar inverter: either use a single hybrid inverter (described below) or add an AC-coupled battery inverter.

Battery inverters

These are inverters that convert AC power from solar system back into DC to charge the battery. Sometimes they are separate standalone inverters that work beside an existing solar inverter. They may also be integrated into the battery unit. One challenge of having both a battery and a solar inverter is that most networks have limits on the total inverter capacity. It's important to check with your installer.

Hybrid inverters

These combined solar and battery inverters convert DC power from your solar and battery systems into AC for your home, enabling them to work together. However, while most hybrid systems can operate during an outage, not all enable your solar system to charge your battery when disconnected from the grid. This will reduce how long your REC can operate in an outage. To enable ongoing solar charging, the system needs an "automatic transfer switch", which is sometimes integrated into hybrid inverters. Hybrid inverters are also unlikely to integrate diesel or LPG generators. If you need to switch to a generator, it would be a manual process.

Energy management and control systems

In more sophisticated systems, it's common to have battery and/or solar inverters and smart control and management systems. These systems help to monitor battery conditions and respond to anticipated energy needs. These more complex systems can be standalone controllers, or Energy Management Systems (EMS), or integrated with battery assets or inverters and in some instances, diesel, biodiesel or LPG generators. These integrated systems may be useful for off-grid sites, but they do come at a high cost. As always, it's important to talk to your installer about what is right for your REC.

Demand equipment

Refrigeration and freezers

Overview: Fridges, cool rooms, chest freezers, or commercial refrigerators all consume a lot of energy, increasing demand. However, some fridges are more efficient than others, and the benefits of having refrigeration may outweigh the downsides in terms of energy consumption. For example, making these fridges accessible to the community can reduce food spoilage, household recovery costs and waste.

Energy considerations: Fridges consume a lot of power and also have high surge or instantaneous power needs, which increases peak demand and system sizing. Having several smaller units could potentially reduce peak demand. In warmer climates, refrigeration and freezing equipment require more energy to keep cool.

Air purification

System requirements: Air purifiers may be useful in bushfire-prone areas where smoke is a concern. These systems filter indoor air with high-efficiency particulate absorbing (HEPA) and carbon filters.

Energy considerations: Energy consumption varies with system size and air volume capacity. Higher-volume units filter faster but consume more power. Units typically ramp quickly to operating demand and maintain steady levels, making their energy consumption the main variable to account for.

Space heating and cooling

Overview: Heating and cooling may be priorities for many regions. Both in places where heatwaves are common, or extreme cold weather is likely. Heating and cooling systems such as Reverse Cycle Air Conditioning (RCAC) units are ideal. They can provide heating and cooling services and are far more efficient than gas or other electric heating systems.

Energy considerations: Reverse-cycle air conditioning systems require dedicated circuits at the subboard (or switchboard) and should be considered early in planning.

Heat pumps and solar hot water systems

Overview: These hot water options are worth considering if hot water is a priority for a REC. Both heat pumps and solar hot water systems are highly efficient. Both systems work well in mild-warm climates.

Energy considerations: Solar hot water systems minimise consumption but often include backup electric elements that can create unexpected peak demand. Heat pumps perform well in Queensland conditions – consult local plumbers to find the best system for your specific location.

Water pumps

Overview: When town water could be affected by a natural disaster, consider installing water pumps to use in conjunction with a water tank. Water pumps will provide water pressure needed for showers, kitchens and washing machines. Water pumps are connected to the building's water pipes and need to be compatible in terms of pressure. For this reason, it may be necessary to either downgrade the pump or upgrade some of the plumbing in the building.

Energy considerations: Although usually used intermittently, consumption should be based on the longest use case. Many pumps have high peak demand spikes when they start. While these spikes are short, they put pressure on a standalone system and should be considered by the system designer. Steps should also be taken to reduce the amount of startup spikes by making sure that the pump is not over pressuring the system, or turning off and back on again frequently.

Backup communication systems

Maintaining reliable communication during power outages is essential for emergency coordination. During natural disasters it's common for mobile phone towers to lose power or become congested, making it hard to communicate with the outside world. However, several communication options can help address these issues.

Satellite communication devices

Satellite phones and messengers operate independently of communications towers. They require a clear line of sight to the sky, which could be a risk in overcast or cloudy conditions. They are typically more expensive than two-way radios but enable communication over wider distances.

Energy considerations: For any communication systems, it's important to consider how they will be powered. Satellite systems and two-way radio base stations may require an ongoing power supply, and their operational consumption should be considered when designing your system. Any handheld units that don't require ongoing power should always be charged in case of an emergency.

Low Earth Orbit (LEO) Satellite

LEO satellites are advanced communication networks which can provide a critical backup layer for communication when terrestrial networks are down. They facilitate rapid coordination of community and support emergency broadcasts. Unlike traditional geostationary satellites, LEO satellites operates at a lower altitude, significantly reducing signal delay and making real-time services like video calls viable in isolated areas.

Two-way radios and base stations

Two-way radios don't require satellites or communication towers to operate; instead, they communicate with other radios on the same frequency. They usually include installing a base station that receives and transmits radio frequencies. Different types of two-way radios are suited to different uses and conditions, so it's important to do some research before making a decision.

Koah Hall powers up

The Koah Hall is a small, designated place of refuge with backup power in the Mareeba Shire.

The average daily consumption at the Hall is roughly 15kWh. This usage includes LED lighting, fans, some refrigeration, water pumps and a few small appliances. Given that all this electrical equipment was considered necessary for the functioning of the hall, and has a relatively small load, the committee decided to back up the entire hall rather than create a separate sub-board for essential equipment.

To power the whole Hall, the committee supplemented the existing 3.5 kW solar system with a new 12.35 kW Aiko solar array, bringing their solar capacity to approximately 15.85 kW. In addition, they added a 25 kWh Sungrow battery system.

Since installation, the solar system has been generating far more than the hall consumes or is needed to top up the battery. Even under cloudy conditions, the system is expected to easily cover the facility's daily consumption and be able to power the entire hall for several days during a power outage.

Checklist 3: Technical design and delivery

The following checklist covers key considerations for technical design and delivery.

- ☐ Have you sought multiple quotes from appropriately qualified installers?
- ☐ Have you confirmed that your installer is aware of your specific needs and intended use for backup power?
- ☐ Have you or your installer calculated the site load, or its expected load based on priority circuits (appliances) for use during backup?
- ☐ Has your installer designed the system to match the site load?
- ☐ Have quotes been provided detailing equipment specifications, installation timelines, system designs, network processes, compliance requirements and exclusions?
- ☐ Have appropriate climate or hazard measures been integrated into the design?
- ☐ Have backup communications systems been considered and quoted for?
- ☐ Have other energy efficient measures been considered?
- ☐ Have ongoing support arrangements been described?

Operating your system

Formalising roles and responsibilities

Clarifying different key roles and responsibilities for your REC is essential. When working with different people, or between multiple organisations, it's critical to establish who is responsible for activities like: seeking funding, managing the REC project, maintaining the system and troubleshooting if something goes wrong.

Where building owners are not managing the REC, it's critical to establish clear agreements on how the site will be used in case of a natural disaster or emergency. A "Deed Poll" or Memorandum of Understanding can be used to set out these obligations.

It's also important to consider who will be responsible for simple maintenance activities, such as keeping solar systems clean, maintaining generators and their fuels, monitoring the systems performance over time and bringing in installers to rectify issues if needed.

Those responsible for day-to-day operations and maintenance activities should receive guidance on how the system works both in normal circumstances, and during outages.

Monitoring systems

Most backup-capable inverters (or other management and control systems) will have some level of monitoring and often offer apps or online dashboards to check system performance. Ideally you'll be able to use these systems to see the battery's 'state of charge' i.e. how full it is, your solar systems output, and in some instances, your site's energy consumption. It may also be possible to integrate electricity billing and tariff information to see if the system is saving the site manager and/or owner money.

Toolbox 12: How to plan ahead

While in an ideal world, everything would happen as we plan, this is not always the case. It's good practice to plan ahead and be prepared for unlikely, but impactful risks. Some key activities to consider include:

- Consider locks and tamper-proof fixings to reduce theft or vandalism risks.
- Stock critical spares on-site: spare fuses, relays, filters, lighting, tools and backup satellite-phone chargers as appropriate.
- Store printed documents onsite, such as manuals, single-line diagrams, warranties and shutdown/startup instructions
- Seek appropriate insurance coverage.
- Budget for repairs, replacements and potential maintenance costs down the track.

Planning for use

Even before a REC is installed, it's worth considering how the system will be used in real-life situations. While it's not possible to predict every scenario, planning can help to ensure the REC is ready when needed and community members understand its role.

It's also important to inform Local Disaster Management Groups (LDMGs), Councils, and local emergency services (fire, SES, police) about your REC. These stakeholders are often interested in a REC's capabilities, particularly if the facility could serve as a safer location, evacuation facility, recovery centre, or operations hub during a natural disaster. Whether the location may be considered for use as an evacuation centre or as a safer location is event-specific. In some cases, Councils are discouraged from making sites known before disaster events, to avoid community members coming together in places they assume will be safe but may not be at that time. So coordinating with Council and LDMGs is important.

These stakeholders can provide guidance on how to communicate the REC's functions to the broader community. This communication is essential to make sure that community members understand when to use the site and what services the REC offers.

In addition, it's wise to test the site and your emergency responses by stepping through what might happen in a real natural disaster. This helps to get site volunteers, staff or managers on the same page, build confidence in your processes and identify improvements for real-life situations.

A final consideration is whether the REC can support existing resilience efforts. Many facilities already host preparedness workshops, training sessions or community gatherings. A REC can strengthen these efforts by providing a reliable venue, power, communications, and essential amenities for planning activities. Identifying these opportunities early ensures the REC becomes part of everyday resilience, rather than a resource only during natural disasters.

Evaluating a REC

Monitoring and evaluation can help a REC assess its technical, financial, community and resilience benefits. For instance, assessing how the system is performing, its impact on electricity bills, how it is being used, its benefits for the wider community and opportunities for improvement.

Key questions to answer could include:

- Is the REC system working as intended?
- Is the REC system creating financial or environmental benefits? I.e. bill savings or emissions reductions?
- How is the REC being used? I.e. for resilience planning, outage events, and other activities?
- Have operational or technical challenges been faced? What could be done better next time?
- How has the REC been integrated with other emergency or disaster responses? Are there opportunities for improvement?
- How could the REC better meet community needs?
- What other lessons have we learned?

Data from energy monitoring systems and bill information can help you evaluate the systems technical, environmental and financial performance. For more social questions, it's good to bring in multiple perspectives, using surveys or workshops.

Checklist 4: Operating your system

- ☐ Establish roles and responsibilities for operating the system
- ☐ When the site owner is not the site manager, seek clear formal agreements that ensure the system can be used as intended
- ☐ Obtain training from installers to ensure people managing the facility understand how to operate the system
- ☐ Formalise emergency management systems and document who has access to the facility, and when to contact emergency services
- ☐ Have contingencies like keeping warranties safe, seeking adequate insurance and having budget for replacement hardware
- ☐ Communicate with council, Local Disaster Management Groups and emergency services and community members regarding the REC
- ☐ Monitor and evaluate system performance, community use and lessons learned from outage events

Final reflections

As extreme weather becomes more common, RECs offer communities a practical way to stay connected and respond to natural disasters. They play an important role in supporting community resilience and recovery by providing the basic services we need that require power. When done well, these systems can also cut electricity bills, greenhouse gas emissions and create spaces for communities to thrive.

Setting up a REC takes time and takes a lot of learning from those involved. But by working with local people, installers and those at the heart of disaster response planning, you can create a facility that truly serves your community when it matters most.

For more resources on backup power and RECs, see the resources below.

Further resources:

- UNSW Sydney (2023). Guide to backup power options for resilient households: Provides a detailed summary of setting up backup power at the household level, with lots of relevant insights for community facilities.
- Energy Consumers Australia, Institute of Sustainable Futures & Community Power Agency (2023), Energy Ready Toolkit: Offers information for disaster planning and response, including energy resilience.
- Community Power Agency (2022), Resilient Energy Centres: A How To Guide: Offer a summary of setting up a REC, in a Victorian context.

Glossary and acronyms

AC (Alternating Current): The type of electricity used in buildings and supplied by the grid.

ATS (Automatic Transfer Switch): A device that automatically switches between grid and backup power.

BAL (Bushfire Attack Level): Rating system for bushfire risk, from BAL Low to BAL FZ (Flame Zone).

Battery: A device that stores electrical energy for later use.

CEC (Clean Energy Council): Peak body for the clean energy industry in Australia;

DC (Direct Current): Type of electricity produced by solar panels and stored in batteries.

Deed Poll: a legally binding, written promise made by one person or organisation, without requiring another party to sign or agree to it.

Depth of Discharge (DoD): Percentage of battery capacity that can be safely used.

DNSP (Distribution Network Service Provider): A company that owns and operates an electricity distribution network (Energex or Ergon in Queensland).

Energex: Electricity distributor for South-East Queensland.

Ergon Energy: Electricity distributor for regional Queensland.

Hybrid Inverter: An inverter that can manage solar, battery, and grid together; capable of backup operation.

Inverter: A device that converts DC electricity to AC electricity.

Islanding: The ability of a system to operate independently when the grid fails; essential for backup functionality.

kW (Kilowatt): Measure of power (rate of energy use or generation); 1kW = 1,000 watts.

kWh (Kilowatt-hour): Measure of energy; 1kWh = using 1kW for 1 hour.

LDMG (Local Disaster Management Group): Council-led group coordinating local disaster management.

Multimode Inverter: Another term for a hybrid inverter; can operate in multiple modes, including backup.

Potable: Safe to drink

PV (Photovoltaic): Technology that converts sunlight to electricity; solar panels.

RECs (Resilient Energy Centre): Community facility equipped with backup power for emergency use.

SAA (Solar Accreditation Australia): Manages solar installer accreditation in Australia

SAPS (Stand-Alone Power System): Complete off-grid power system, usually larger and more complex than typical Resilient Energy Centres requirements.

STC (Small-scale Technology Certificate): Renewable energy incentive; reduces the upfront cost of solar systems.

Sub-board: Secondary circuit board containing only backed-up circuits.

Three-phase power: A type of electrical supply with three power lines; it allows larger systems and loads.

VPP (Virtual Power Plant): A network of small, distributed energy resources that are digitally connected and managed as if they were a single power plant.

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