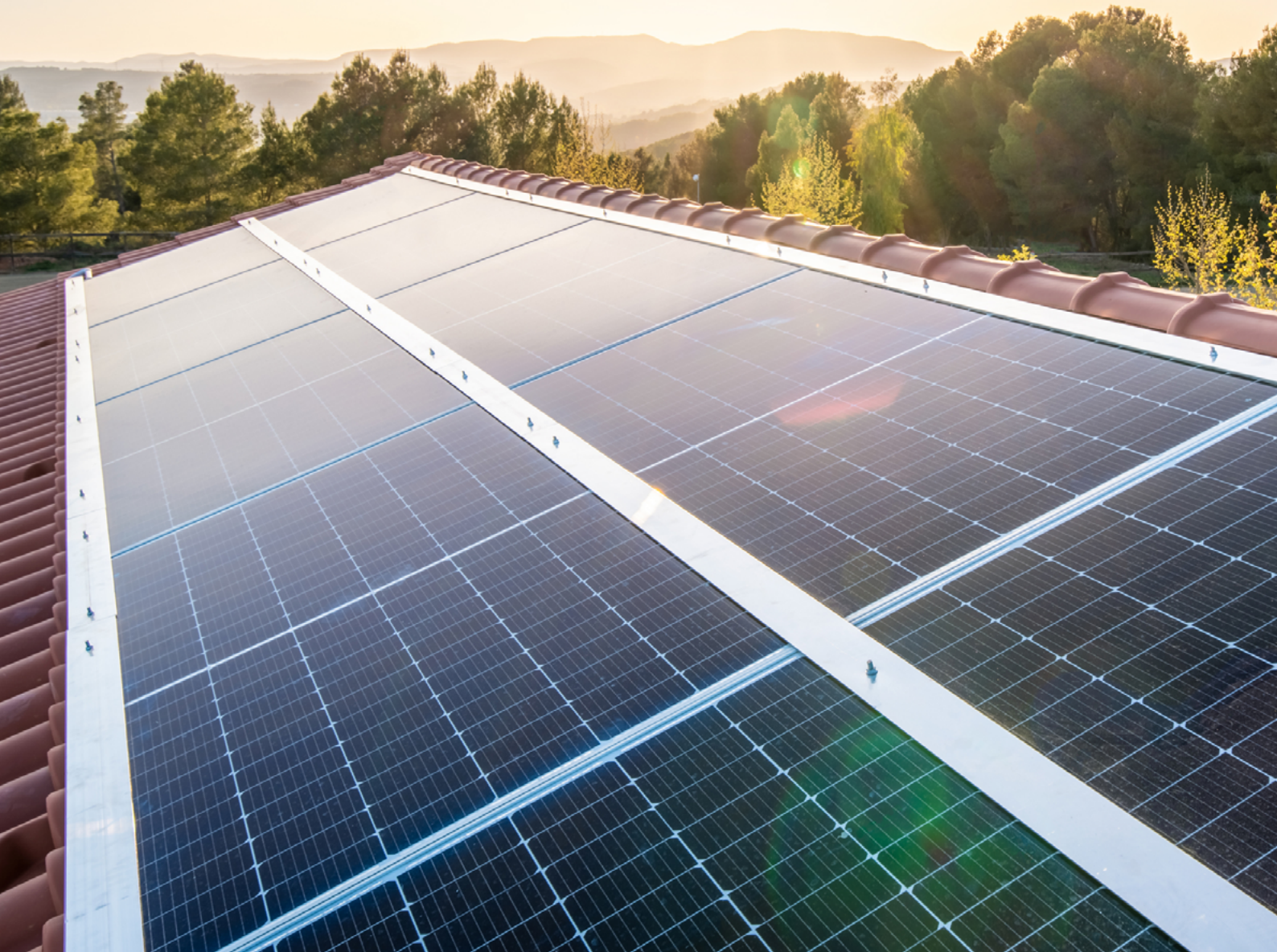
community power agency

Resilient Energy Centres

A how to guide



Community Power Agency partnered with the Energy Innovation Cooperative to deliver a component of the Resilient Community Energy Smart Grids Pilot, exploring how regional communities can co-develop and design community energy assets for smarter energy transitions and greater resilience planning. The broader inquiry was originally presented and endorsed by the Smart Community Energy Innovation Network, and was successful in securing funding through the Latrobe Valley Authority's Smart Specialisation Strategy program.

The authors would like to thank the communities who gave their time and expertise to contribute insight, in particular to our case studies: St Albans School of Arts, Toward Renewable Energy Kiewa (T.R.E.K), Southcoast Health & Sustainability Alliance (SHASA) and Moruya Preschool.

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1. About this guide

Since the mid 2010s, regions across Australia have been experiencing extreme weather events of increasing intensity and frequency. Flooding events, bushfires and wild storms have destroyed thousands of hectares of property and bushland, severely affecting people's homes and businesses, our wildlife and our general sense of stability.

Climate change is here and affecting the Australian population now. Communities are actively seeking ways to respond and rebuild in a way that will better prepare them for future extreme weather events. When such events occur the resilience of electricity, gas, water and other essential services is tested. Communities rely on these services, so it is crucial that infrastructure is developed and maintained to address these challenges. It is also vital that local people guide the process to design resilience efforts so they are fit for purpose and meet the needs of communities as they respond to these extreme events.

This guide is intended to support communities to develop plans for greater energy resilience, specifically in creating places with a more reliable energy supply for times of need. It is written for community members, particularly those living in small regional and remote areas, and at the end of the electricity distribution lines. This guide is intended to help communities have discussions about how they can create greater energy resilience and provide inspiration for what is possible. Ultimately,this guide can assist communities to establish Resilient Energy Centres, where appropriate, and build their capacity to respond and adapt to our changing climate.

There are many types of resilience that communities need in times of stress. As well as energy resilience, social, economic and emotional resilience are important for communities to thrive. When communities have their basic energy needs met, they will be better able to turn their efforts to these other resilient activities. Hence this Guide focuses primarily on energy resilience.

Resilient Energy Centres are not a place of refuge, an emergency relief centre or a place of last resort.

Resilient Energy Centres are not a place of refuge, an emergency relief centre or place of last resort. Those places are all specific and managed by state and local authorities trained and resourced to operate them.

In Victoria, there are five places of refuge around the state. These are purpose-built/modified facilities for refuge during a fire and offer a last resort shelter option if your evacuation plan has failed and you cannot leave the area in the event of a fire.

Emergency relief centres are set up by the local council on an as-needed basis, usually when a significant number of people need to unexpectedly leave their homes. The location of the emergency relief centres will be determined at the time of the emergency, as they will need to be located away from the immediate threat.

This is a place where affected community members can come for a range of support including:

- finding emergency information
- reconnecting with their community
- accessing relief support services to assist with their immediate need

A "Neighbourhood Safer Place" aka "Bushfire Place of Last Resort" (NSP - BPLR) is an open-air location (e.g. a sports oval) that is assessed by the Country Fire Authority as being 'safer' during an emergency if people can't evacuate safely. There are several around Gippsland.

This guide does not propose the creation of either a new place of refuge or NSP-BPLR. A Resilient Energy Centre should not be used in the case of a local fire and should be evacuated if so threatened.

To avoid confusion and conflict with regional emergency plans, each Resilient Energy Centre should have signage both outside and inside the building to the effect of the following:

"This is not a place of emergency refuge"
"If there is a direction to evacuate, please do so"

2. Resilient Energy Centres

This guide is focused on providing resources and guidance for setting up Resilient Energy Centres. A Resilient Energy Centre (REC) is a building that has been equipped with a backup energy system so that it is energy independent should the electricity to the region be cut off from the main grid due to a natural disaster, extreme weather event or other reason.

This guide focuses on enabling communities to arrange for the installation of appropriate back-up energy systems that will meet their needs in a crisis. However, there are several other elements that are complementary to energy resilience, which will be briefly outlined throughout the guide.

These Resilient Energy Centres can provide community assistance in a number of ways that are outlined below. RECs may be a community building or a business that can be used by the community when needed. Outside of the buildings' normal function, Resilient Energy Centres will primarily be available for community use in two phases: planning for and in the lead up to a known natural disaster, and in the response and recovery to a natural disaster or other event causing power to be cut off. However, the ultimate use and functions will be determined by local communities who are leading the development of these centres in collaboration with key stakeholders.

Possible functions the Resilient Energy Centres could provide include:

Planning phase functions

- A place for local residents to organise and plan resilience activities.
- Information hub for people in the local area to access information about potential upcoming natural disasters.

Response and recovery phase functions

- Back-up or 'energy islandable' technology that can provide 12-16 hours of electricity per day when upstream electricity network lines are severed.
- Energy supply for people in the local area to charge electronic devices and cold-store food while their homes don't have access to electricity.
- Gathering place for people in the local area who are not able to return to their homes.
- Basic comforts can be met such as a hot or cold beverage, shower & toilet facilities, access to cooling or heating, and basic meals can be prepared.
- A recognised place where local residents can strategise for response efforts or recovery following a natural disaster once the immediate threat is low.

Discussion on resilience

Resilience can have various meanings to different people and different communities. Therefore, this guide doesn't give a definitive answer to what resilience will look like in your community however intends to give the tools and some examples for you and your community to evaluate what resilience is for you.

As well as energy resilience, social, economic and emotional resilience are important for communities to thrive. When communities have their basic energy needs met, they will be better able to turn their efforts to these other resilient activities. Access to a Resilient Energy Centre allows other things to take place, for example, community reconnection and a space for people to rest. While other forms of resilience are also important and mentioned briefly throughout, this guide is focused on energy resilience.

Sometimes it is easier to describe what Resilient Energy Centres are not, so let's start with some limits:

- They are NOT energy independence: RECs are not designed to be replacing all energy needs, just the important ones to maintain a certain standard of living for a period while other sources of energy are being repaired or reconnected.
- It is NOT long term: To be energy resilient, energy needs may only need to be covered for a relatively short time. How long will be dependent on what is required and the different circumstances in your community.
- It is NOT a replacement for emergency or disaster programs: RECs fill the gaps and support the emergency response in your community.
- It is NOT a place of refuge or an evacuation centre: RECs are not designed as places for sleeping, see discussion below.

3. Starting your energy resilience journey

Establishing a Resilient Energy Centre ultimately provides support and assistance to local people in times of the greatest need. In starting this energy resilience journey it is important to understand what is happening already and what the needs and desires of your community are.

Engaging the community early and consulting with key stakeholders is essential to ensure that the design and vision of a Resilient Energy Centre reflects the local context and delivers benefit at critical times. Good community engagement can build trust, feelings of ownership, and a sense of empowerment through providing meaningful opportunities for the wider community to input into the project's development. It also ensures that the project delivers the most possible benefit, and meets the least possible resistance. Getting people on board with the vision will identify community champions, some of which may offer financial support, volunteer time or their expertise to the project.

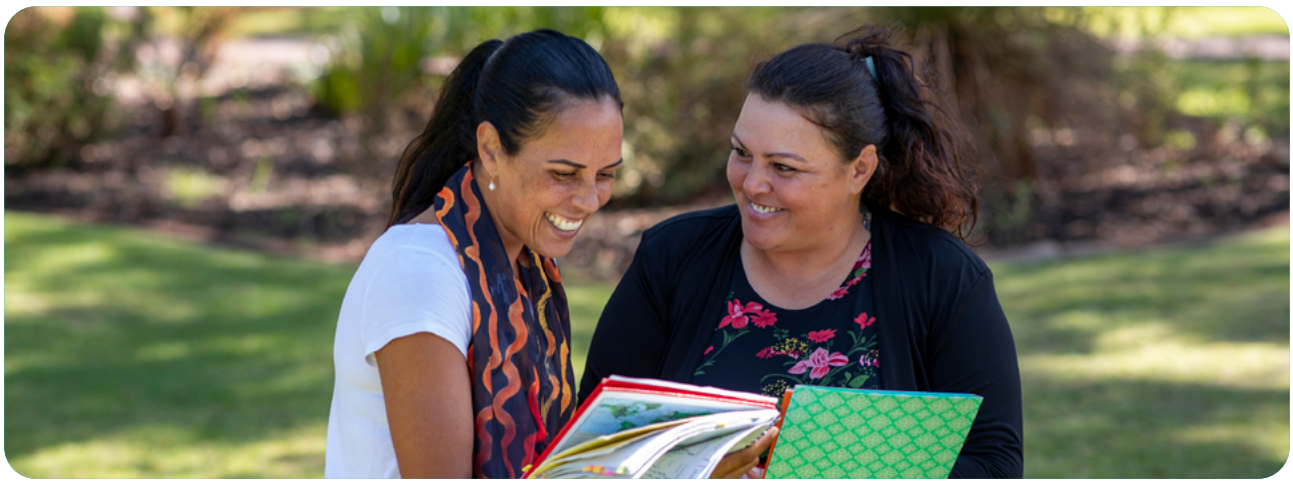
Community Engagement[1]

Quality community engagement fosters relationships and a sense of collaboration and shared decision making. Key principles for community engagement are mutual respect, mutual benefit, responsiveness, appropriateness, authenticity and transparency. Good engagement also requires those involved in the project's development to be very good listeners and be present in the community often, observing and learning.

Community engagement can cover a range of activities, reflecting different levels of engagement. It is important to consider how deeply local people and stakeholders are engaged in the process, and why, and design your community engagement approach around this. Clear and consistent communication throughout the project life will help to keep people engaged as well.

Having a plan for how you will communicate with key stakeholders, social media and the media throughout the project will help to direct this and maximise your positive exposure. Remember to ensure your message is reaching the different parts of the community, not just the dominant spaces. This will require thought around how to communicate with a variety of people such as people who are older, or maybe speak other languages.

1. Adapted from A How to Guide for Community Renewable Energy by Jarra Hicks, Nicky Ison, Jack Gilding & Franziska Mey – April 2014.)



Community Survey

A great way to garner community feedback on a scale is to conduct a survey. Surveying the community will help you to better understand the local attitudes, opinions, experiences, and needs as they relate to the project. Even if you have good community representation in the core organising group, it is still a good idea to reach out more broadly. A community survey helps to align the project with the needs and expectations of the people who will essentially be the beneficiaries of the REC. It can also be an excellent way to gauge opinion of different options associated with the project.

When designing the survey, remember to consider the various segments in the community and how they might participate in this process. Consider different methods of survey distribution including online or via email, paper versions or face-to-face interviews in public places and at events, or even focus groups. Ensure that plenty of time is provided for people to learn about the survey and input into the process. Publicising the survey widely in local media and through community networks will be important to get a high level of response and provide meaningful data that can inform the project.

QUESTIONS YOU COULD ASK

What electronic devices do you most need in an emergency?

_____

How long do you think you can go without power?

_____

How long do you think you can go without a shower/hot water?

_____

How important is air conditioning for you?

_____

Is your house set up for very hot or smoky days?\Where would you go if you had to evacuate?

_____

Where would you go to get help locally?

_____

4. Identifying potential locations for resilient energy centres

One of the first things to consider in establishing a Resilient Energy Centre is whether an existing building can be retrofitted to meet this need. Utilising an existing building structure will significantly reduce the time and cost as the structure to host the energy resilience equipment is already built.

Each community is different and while case studies can inspire ideas, the best chance to identify a good location for a Resilient Energy Centre in your community is to keep an open mind and take a good look at what facilities exist in your town. This section has information on how to survey your local area for potential sites, what features those sites might have, and some good places to start looking based on what other communities have experienced.

Existing facilities

At this stage identify potential buildings or facilities that exist in your community. This will help identify the key stakeholders that you need to talk to (e.g. council, building owner, group using facility) and also provides some different options that you can pursue. Below are some steps to take and places to consider, followed by key features to look for in potential sites.

Speak to your council

Starting a conversation with your local council officers can help the process and potentially save some duplication of effort. Some councils may already have a good idea of potential sites which have the features discussed above, or they may be able to help research them. Regardless, having the plans known to the council generally will help speed things up if you do need their help or approvals in the future. Council support is often needed for many of the grants available for recovery and response to natural disasters (see section 8 for more info on grants). Local Government has the mandate for disaster planning at a local level with structures to include emergency services.

The officers you should be looking to speak to are:

- Bushfire recovery/emergency planning officers
- Community engagement/sustainability / environment officers
- Infrastructure and assets manager

Consider places that the community already uses on a regular basis

Trust and familiarity are important in a crisis scenario. Good places to start are the buildings and facilities that locals already use and are familiar with. Cross-reference this with responses to the community survey question - where do you go for help in the community? This could be a local hall, church, place of worship, sports centre, or bowls club; the important thing is it has a prominent place in the community and is known to as many people as possible.

Consider facilities already designated for similar use

In some cases there may already be facilities that are set aside for use in an emergency, these could be 'neighbourhood safer places' or a designated evacuation and relief location by the Country Fire Authority. Check your council's Emergency Management Plan and talk to your local CFA to identify these. This guide doesn't propose or explain how to set up one of these places, but if one already exists in your community, it may be able to be extended to also help the community following a natural disaster or crisis.
Please take note that places like this will have some conditions:

- Any new community installations won't affect its function in an emergency.
- If it is used by emergency services, the priority must go to those services.

Consider local business and private facilities

Private business premises, whilst slightly more difficult to manage, especially if a council or public grant is involved, can still provide good options for a Resilient Energy Centre.

The most important feature of a facility that is privately owned is that it can operate as a REC when needed. Continuing to operate as a business when needed may not be possible. For instance, there is little point having the local grocery store as a REC as it will likely want to keep trading if it can. A good example is a childcare centre, that will likely not be needed if there is a long-term outage but can aid the families of the children it normally cares for by providing access to electricity. This is highlighted in the Moruya preschool case study mentioned in this guide.

Businesses like this work well as RECs because they most likely won't be trying to operate as a preschool after an emergency and can be used solely as a REC. The business case for installing the system is also expected to be better because there is a use for the power on a day to day basis as well. So when the facility is not acting as a REC, the business can benefit from the cheaper power and when a REC is needed, the business isn't needing power for its own operations. A business seeing savings from a REC installed system could potentially create a small income for the community if set-up as a community energy project. In addition, this means that the system may not need to be maintained and tested by the community as much because it is not sitting idle.

When looking at potential businesses, consider the results of the survey and strategic questions. For example, if the community needed large amounts of cold storage during a prolonged power outage, a café that already has large commercial fridges may be willing to allow the community to use them during a crisis if it were retrofitted with a back-up energy system.

Once you have a list (be it short or long) of potential facilities, the next step is to compare them against the needs identified from your community survey and ask some strategic questions, such as those outlined below. Answering these types of questions will help to identify what needs to be installed or retrofitted to achieve the desired level of energy resilience.

STRATEGIC QUESTIONS TO ASK OF POTENTIAL REC SITES

Is the site an accessible location for your community?

- Location in relation to houses, town centre & main access roads
- Whether the entry is accessible eg narrow stairs may not be appropriate

Is there access to easy and safe evacuation routes?

- The REC should not be isolated or able to be cut off should people need to evacuate.

What is the size of the building?

- How many people could comfortably fit inside?
- Does this match your community's needs?

What is the roof structure?

- Is solar PV installed?
- Is the roof in a condition to host solar PV?

What amenities are available?

- Toilets, kitchen facilities or ability to set up make-shift kitchen
- What other amenities may be needed for your community? Consider air conditioning, cold storage, showers, disability access, diesel generators

What is the Bushfire Attack Level (BAL)?

- A building usually does not have a known BAL, this is something that fire safety assessors will perform.
- The reason to know this is not to make sure it is a safe place in a fire, but to locate a REC somewhere that will likely be standing when it is needed after the immediate danger of bushfire has passed. It is not necessary but recommended.

Working with installers

Once a potential site is found, begin conversations with a solar or energy systems installer. They will help you understand what is required and what is possible. They will also be able to give you an idea of the costs of the technology you require.

Developing trust and communication

It is very rare that energy systems robust enough to provide energy resilience are simple and cheap. For this reason, a lot of discussion with the systems designer is required to nut out exactly what is needed and how it should work. Case studies are of limited use here, as each site is different and the needs of each community are different. Most important is to have a clear purpose in mind for the system and to communicate that clearly to the person designing it for you.

This two-way communication should also improve the trust if an installer is not as well known to the group. As most of these systems are likely to be in very regional or remote areas, it is likely that a local installer will be known to members of your community and they will know if a person is trustworthy or not. For this reason, it is better to find a systems installer that is as local as possible, this will also help with long term management of the system.

CAUTIONARY TALE

"A community group on the mid-north coast of NSW had the foresight to get batteries installed at their local hall. However they had the misfortune to discover when a bushfire cut off the power supply that those batteries were not installed to be islandable - the installer had not understood this was a key part of their use."

That's why it's important to be clear with installers what functionality you want and when.

KEY QUESTIONS TO ASK ENERGY SYSTEM INSTALLERS

- What other installations have you or your business completed?
- Where are you and your business based, how long have you been in operation?
- Have you worked with a community group before?
- What can we expect in terms of the process? For example, how long does a quote take? Above all ensure the installer visits the site before providing a detailed quote and understands the purpose of the system.

5. How to establish a resilient energy centre

Once a location is found the next step is to figure out who will manage and be responsible for the Resilient Energy Centre and whether they are willing to host it and be actively involved in setting it up.

Finding or establishing an organisation

It is quite possible for a community to organise the upgrading of a local building to a Resilient Energy Centre and not need to establish a new organisation. However, an organisation is needed to do at least two things: own and manage the system and equipment, and to raise funds.

The reasons why a new organisation may not be required could be that there is already an organisation established that manages or is associated with the building that is willing to take on the project. Similarly, there could be a local environment or community group that can make the project a part of its activities. In addition, if the building belongs to the council, and they are proactive in the relationship, it is possible for the council to be the host of the project and apply for funding either through grants or state projects in partnership with the local community.

Using an existing organisation

There may be a logical organisation within your community that can take on this project. Key decisions to make with the group include who will lead the project between the community organisation and site owner, who will apply for grants, and who will manage the ongoing operations (detailed further below).

It will be important to make decisions with the whole community in mind, not just for the buildings' usual patrons. Making these decisions may require a separate subcommittee within the organisation with additional external members who are driving the idea of a Resilient Energy Centre.

Creating a new organisation to establish a REC

In the case where an appropriate organisation cannot be found, a new organisation will most likely need to be set up to establish the REC.

One big advantage to setting up a new organisation is that the governing documents help set up a shared vision for the project. This will also help in speaking to the community and gauging interest in the REC. An organisation is by no means necessary to do these activities, but it may make it easier and will likely be required when finding and securing funding. Ultimately, whether you need to create a new organisation or not will depend on what funding is available, who it is for, and how it's distributed (see section 8 on funding).

TO ACNC OR NOT ACNC

Organisations can register with Australian Charities and Not-for-profits Commission (ACNC) as a not-for-profit (without DGR). This process is relatively simple and may aid in accessing grants. It requires specific clauses in the Constitution of the organisation but means profits made by the organisation are put back into operations and not distributed to members.

DGR stands for Deductible Gift Recipient and is a charity status with the ACNC that allows donors to reduce their taxable income by the donation amount. This can attract larger and regular donations.

To achieve DGR registration a lot of time and effort is needed. This is usually not worth it for a one-off project of this scale, however an auspicing arrangement can be set-up with a known DGR organisation to access donated funds.

Visit ACNC for more information https://www.acnc.gov.au/for-charities/start-charity/not-for-profit

This guide some possible structures that could be useful. Those outlined are most commonly used by community groups and variations on each of these are possible. Broadly speaking there are two types of organisations: not for profit - where there are no financial benefits to membership, and for profit - where the organisation can provide returns to members/investors. There are also two forms of governance: democratic - where each member (person) has an equally weighted vote in meetings/decisions, and proportional - where votes are based on shareholdings.

Any combination of the above can serve as a fair and robust community organisation, it's just a matter of thinking about what could best suit your community's needs. Then focus can be placed upon creating a vision and set of Rules or Constitution.

Potential Organisational Structures

While there are several organisational structures the following are most likely to meet the needs of a community oriented group.

Incorporated association

- Relatively quick and easy to set-up
- Able to have members, Governed by a committee of members, it needs a Chair and Public Officer (aka Secretary)
- Minimal ongoing administration & legal requirements, regulated by state bodies
- Able to take on loans, own property and apply for grants

Note: For more information on organisational structures in relation to community energy projects or if your community is interested in setting up an organisation that can own assets that people can invest in, refer to the Victorian Guide to Community Energy and other guides mentioned in the Resources section at the end of this Guide.

Co-operative

- Requires at least 5 people as members to set-up, model rules adequate for most
- Democratic governing structure, one member = one vote
- Certain decisions require majority vote
- Able to take on loans, own property and apply for grants

Company limited by guarantee

- National substitute for an incorporated association, regulated by ASIC
- Governed by board of directors, minimum administration if remaining small
- One member, one vote rule, however quorum is only two members
- Able to take on loans, own property and apply for grants

Establishing a REC without an organisation

If the equipment for the REC can be owned by the building owner (e.g. council or business) and there is no need for a separate community organisation to apply for grants, an additional organisation may be unnecessary. In this case the community can support the building owner in the activities of setting up the Resilient Energy Centre and applying for funding.

It may be that in order to ensure that the building or energy is available when the community needs it a 'Deed poll' or a Memorandum of Understanding can be used to obligate the building owner to act in a certain way during a crisis. It is important to check the requirements and conditions of a Deed Poll. The goal here is not to force anyone to do something, but to make sure from the beginning that everyone has the same expectations.

DEED POLLS

A deed poll is a contract that is signed by one party that obligates that party to act in a certain way. Usually this means paying a beneficiary, but can also outline how a Resilient Energy Centre should be used in a crisis.

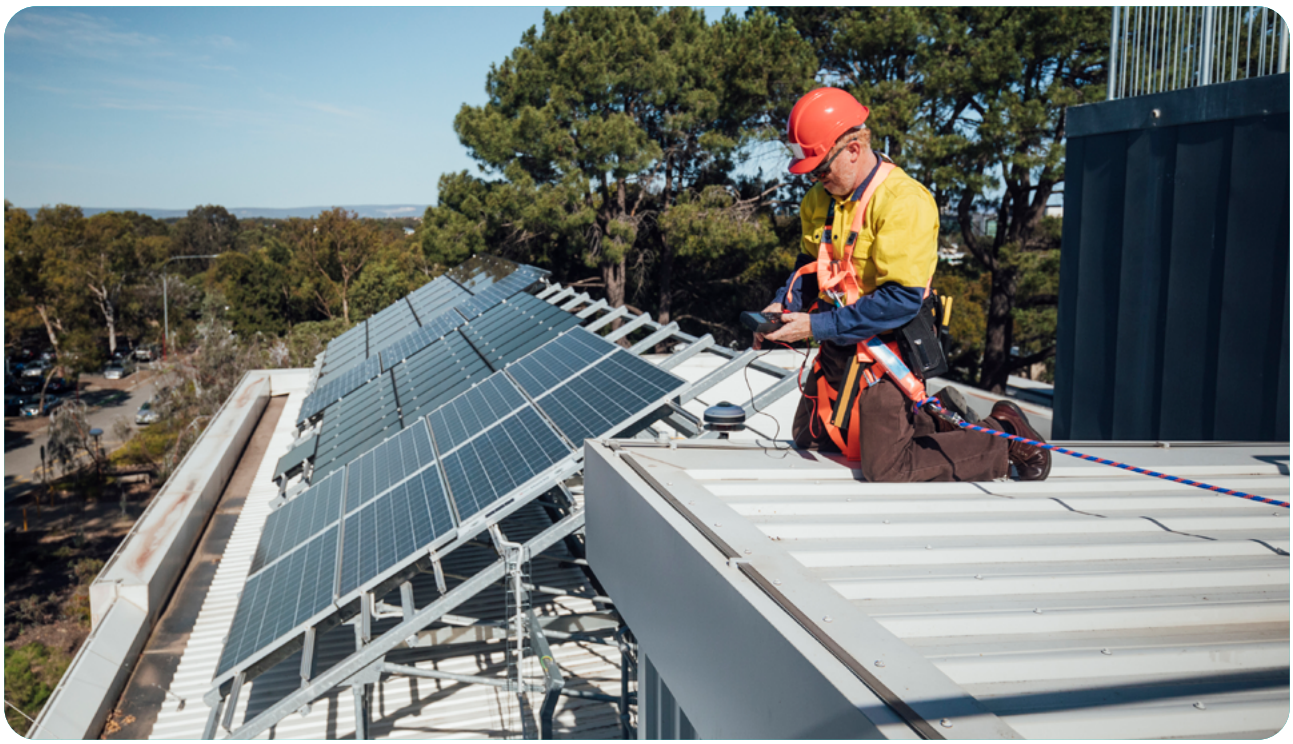
Ongoing operations

Integral to establishing a REC will be planning for the day-to-day and long-term operations, including responsibility for maintenance.

Panels of a solar system can last over 25 years, and the inverter/battery up to 10 years depending on what technology is being used. Thus it is important to consider who will be responsible for the ongoing maintenance and safe disposal at the end of the system life or potentially replacement of the system.

The easiest solution is to have the building owner/occupant responsible for maintaining the system and monitoring its performance. Being at the location, they can:

- Provide access for trades workers
- Notice reduced production or technical issues
- Initiate behavioural change on energy use
- Benefit most from the system on a day to day basis



To aid with the costs of managing and maintaining the system, the installation should provide some ongoing benefit to the owner/occupant of the building, be it in energy savings or a small income from electricity exports (see more on these in the following pages). This creates a long-term incentive for the system to be properly maintained and ready for use in an emergency. It may be important to create a mutual agreement, such as deed poll, between the building owner, users and the community for how the space will be used in a crisis situation when it needs to operate as a REC.

Alternatively, if a separate organisation to the building owner/host is managing the various pieces of equipment that make up the REC it is important to lay out clear agreements for maintenance, where any surplus funds generated are allocated and when and how the building can be used as a REC.

If the REC is installed in a building that isn't used regularly, then a system for checking the safe and proper functioning of the system should be implemented.

Find out from your installer what an appropriate maintenance plan would be for your system. For example, nominating a person to turn on all the systems once per month.

6. Technology options and considerations

As discussed in the section on identifying a site, the earlier you can get an installer involved in the process the better. Since they should also be a licensed electrician, they should be able to advise on what technologies or equipment is appropriate for your installation and suggest options for what to choose.

To help facilitate this discussion with trades people, general information about what is available and what community groups should consider is provided. This section avoids looking at specific brands, models or sizes, because that will be different for each site. However, it will describe some of the use cases for different types of equipment and mention some brands as examples of what is possible.

Generally there are two categories of equipment that a Resilient Energy Centre will be looking to install:

1. **Generation equipment** - the providers of power, including batteries or other energy storage as they are ultimately there to provide the power when needed;
2. **Demand equipment** - the things that use the power, also referred to as 'load'.

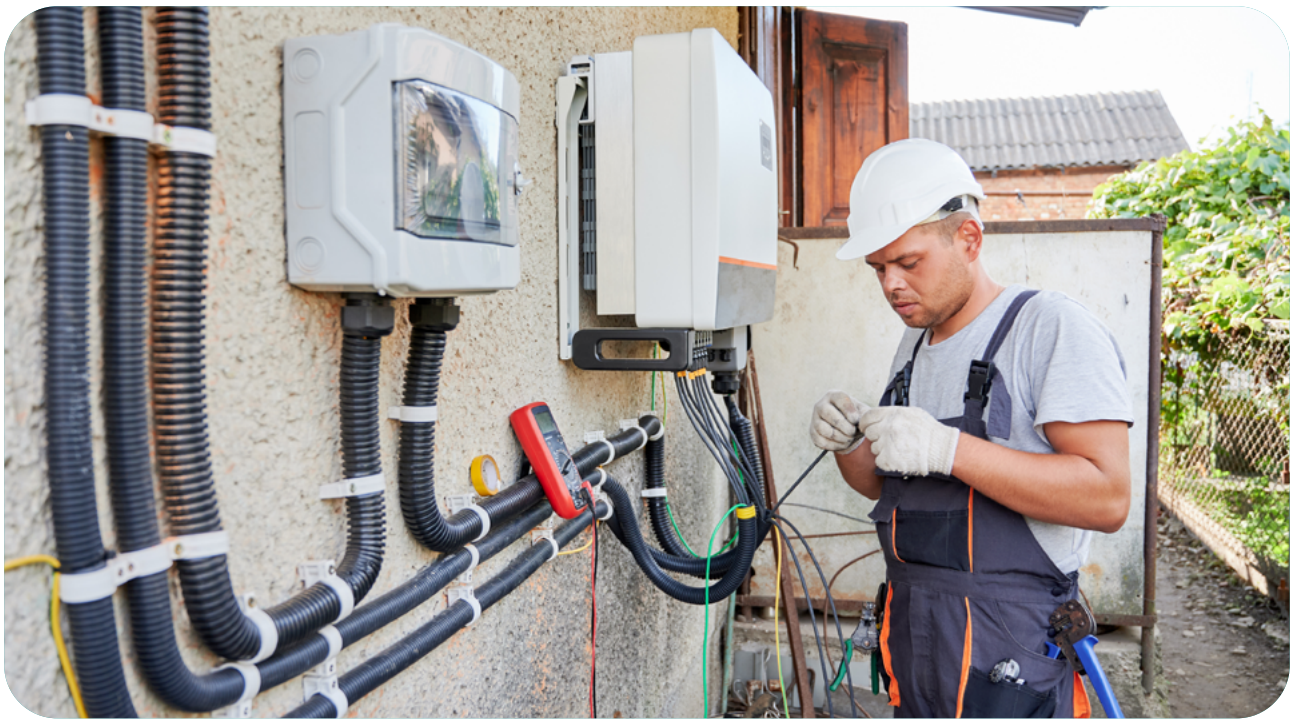
In designing a system, the relationship between these two factors will be dynamic. Budget will dictate the amount of generation available which will limit the amount of demand that can be addressed.

On the other hand, the level of demand will determine the amount of generation needed. Knowing what generation and demand a system potentially has, allows for creating compromise that will lead to a more robust system.

The technology solution recommended for Resilient Energy Centres can be thought of as an 'islandable' energy system. A system that will typically be grid connected that can operate when there is a grid connection outage to the town where it is located.

There are several other types of related technology solutions for energy resilience remote areas, the most common being microgrid and stand-alone power systems (SAPS). However, these are considerably more complex, require the participation of network operators and often cost in the multi-millions. They are briefly outlined for clarity, but are not recommended for a small, local resilience project.

Note: there may be other equipment that you may want to consider that does not have clear generation or demand, such as communications equipment, water tanks, firefighting pumps, and cooking equipment.



Related technology:

- **Microgrids** - the definition of microgrids is wide and contested, however generally understood to mean grid-connected systems in a geographically defined area that provides the entire electricity needs of that area and that can be "islanded" ie. continue operations when cut off from the grid. They are extremely tricky to set-up from a regulatory point of view, let alone a technical one. For this reason they are not discussed further in this guide.
- **Stand Alone Power Systems (SAPS)** - These systems are designed for remote areas instead of a grid connection, usually for an individual site, to address network challenges and constraints like fire risk, reliability and resilience. They meet the entire electricity needs of the designated area and are most often built by Distributed Network Service Providers (DNSPs or network operators) For example AusNet, Essential Energy etc. In some remote towns the network operator may already be considering SAPS for some customers.

  Rapid response SAPS are designed to be used when needed and otherwise are in storage. They are designed to be easy to disconnect, access, transport and reconnect in order to keep vital services operating and are mostly temporary. Regardless of the technology, these systems are usually operated by the network (or in some cases Army) and are for public infrastructure (e.g. telecommunications).

Generation & Storage

There are various technology types for use in generation and storage of electrical energy. Here we discuss briefly their use case (how the equipment is best used),potential issues or limitations and considerations for each technology type.

TECHNOLOGY | SOLAR SYSTEM | PANELS AND INVERTER

The cheapest and simplest renewable energy technology, photovoltaic (PV) panels operate on a direct current (DC) and it is the inverter that converts this to a useful alternating current (AC). PV panels rarely operate at 100% efficiency, so systems are often designed to have a maximum panel output higher than the rating of the inverter, also called oversizing. E.g. panels totalling 3.5kW may be connected to a 3 kW inverter. This sizing is to get the maximum use out of the inverter, which is usually the more expensive part of the system.

Quality and Warranties

PV panels are often rated into a Tier system with Tier 1 being the best. Ultimately, any panel can fail and what is more important is that the panel has a solid warranty and the installer is able to make good on that warranty through their suppliers.

Use case

On its own, solar PV is best used for supplementing other sources of power, i.e. grid connection or generator. Solar PV reduces the amount of power from these other sources which makes the variability of the solar less of an issue. It is also relatively low maintenance (not no maintenance) and able to be left relatively under-used until needed.

Potential issues

In the case of a bushfire, heavy smoke can linger for several days and reduce the effectiveness of solar when it's needed most.

A danger of solar is that if the sun is up (even if it's a bit covered) the system is producing power. If the building is damaged or flooded, this can mean that there still may be live wires somewhere even if the grid is disconnected. For this reason all solar systems have isolator switches and it is important to know where yours is.

Considerations

The orientation and angle of panels in relation to the sun which can also affect oversizing. In Australia, an optimal system usually faces north on an angle of about 33 degrees. However, there are many cases where un-optimal orientations can deliver good results depending on what the needs of the system are and an experienced installer will be able to design a system that suits the needs of the site.

While solar PV can be relocated, in most cases it will be more economical to install new panels than try to reuse old panels, unless the cost of removing the panels is not a factor, say in demolition of a building. Inverters may be able to be relocated, but would need to be matched to the new system. Ensure the solar panels can still produce when the grid connection is interrupted.

BATTERIES

Almost all batteries for solar use will be lithium ion which have a 5-10 year warranty life depending on manufacturer. This usually means that over that time they will lose about 20% of their capacity, however, the battery is still quite functional after this period despite having limited capacity. The battery has two measures, the most prominent is the storage, measured in kilowatt hours (kWh). This is the amount of energy it can provide over a time period, e.g. a 5kWh battery can provide 5kW for one hour or 1kW for 5 hours. The second measure is the max output in kilowatts (kW), this is how much power can be supplied in any one moment. This is important for the demand side and we will discuss it more in the section below about demand.

Quality and Warranties

Like with PV panels, you want to make sure that the installer has an ongoing relationship with the battery supplier to ensure that any warranty issues can be resolved quickly.

Use case

Batteries are useful to store power generated for later uses. Ideally the difference between when the power is generated and when it is used is under 10 hours so the battery can be recharged again the following day. Most notably this is in combination with a solar system, but it can also be used to cover very short power outages.

Potential issues

Batteries need to be protected from heat and cold to operate efficiently. They also have a very high cost per kWh of storage, making long term or high demand options usually untenable.

Considerations

When including a battery, it is very important to make it clear to the installer what the battery will be used for.

For example, does it need to pick up a loss in power quickly to supply sensitive medical equipment or will it need to be able to handle being used slowly throughout the day/night while the grid connection is interrupted and only charged back up once it has run low; does the battery need to run independently or will it supplement other systems like a generator or grid power.

Some battery solutions can be very mobile, lifted by forklift and transported by truck. These systems are often self-contained and more expensive than more modular systems. If mobility is a feature, it will strongly affect the choice of battery.

LPG GENERATOR

Often also able to run on natural gas, LPG is usually a more accessible fuel source for generators. These generators come in various sizes, but usually operate better at a steady rate just below their max rated capacity. A 10kVa generator works fine at 6kW but can ramp up when needed. Generators also often come with their own inverters and can be connected directly into the wiring of a building. However, if they are meant to be operating together with a solar and battery array, the whole system will most likely need to be run through an energy management system in order to run properly. The alternative being that different appliances are run on different systems.

Use case

Needed for on-demand and long term generation, they can supplement the other power sources or be used as a back-up power source.

Potential issues

Regular maintenance is required for the generator to operate reliably when needed. LPG is highly flammable, but safe handling and storage practices will prevent accidents. However, during a bushfire, the storage of gas bottles (usually outside) may become a risk to the building.

DIESEL GENERATOR

For some communities, diesel may be easier to come by than LPG. In these cases a diesel generator may be preferable, but where LPG is available it is usually the better solution. Diesel generators need regular maintenance and running to keep operational. They do however come in much larger capacities than other types of generators and are very reliable if well maintained.

Use case

When a generator is needed and LPG is not a viable option or a very large amount of capacity is needed.

Potential issues

Diesel can denature (go off) if stored for long periods. This means that both the generator needs to be run regularly and diesel potentially disposed of and replaced on a semiannual basis.

Considerations on LPG and Diesel generators

As these sources of power still run on fossil fuels, communities wishing to be carbon neutral may be resistant to the idea of including them in their Resilient Energy Centre.
The reality is that at the moment, the energy needed to run a REC that can deliver the needs of a community in a crisis don't exist for renewable sources at the price point that most communities (and grant givers) are able to pay. These fuels are also common, easily transportable and a known quantity to organisations and departments providing emergency supplies. Substituting only the last resort energy requirements with fossil fuels balances the immediate safety of the community with the long term goals of decarbonisation.
In saying that, efforts can be made to update any existing generators to modern, more efficient models to make sure that the amount of fossil fuel being used is minimal.

Demand

Demand, also referred to as 'load', is made up of the appliances and equipment that use power from the REC. Demand is made up of two main considerations: consumption measured in kilowatt hours (kWhs), and peak demand measured in kilowatts (kW).

Consumption is how much energy is used and will affect how big your solar and battery system needs to be. The more power being used the more it will cost to store or create enough power to run those appliances for the amount of time they are needed.

Peak demand is a measure of the maximum amount of energy the device can use at any given time, usually at startup, or when working very hard. The implications of a high peak demand is that it can draw on more power than the system can deliver at any one moment, and cause circuit breakers or fuses to trip. Making sure that high demand devices aren't switching on at the same time is as important as monitoring overall consumption.

As discussed, it is important to understand what the RECs demand is in order to better design a generation system OR to more efficiently manage the energy that is available so that it is being used where it is needed.

ENERGY EFFICIENY

When setting up a solar or off-grid system, reducing demand through energy efficiency will mean being able to power more devices.

The Victorian Government provides discounts for energy efficient appliances. You can find out more about the program by visiting the Victoria Energy Saver website here.

COLD STORAGE (FRIDGES & FREEZERS) This may be a vertical fridges or a coolroom, however ideally a chest freezer or deep commercial fridges are ideal as they are most efficient at maintaining temperature. How this storage is used will depend a lot on the type of appliances, will it be for communal food or for individual households to store separate items.	CONSIDERATIONS Both consumption and peak demand are relatively high mostly due to the fact that they need to be run throughout the day (especially in summer) and the appliance compressor switching on and off, creating peaks in demand. The larger the compressor, the bigger the peak. Having multiple small units can reduce peak demand at any one time (as long as they don't all switch on together) and reduce energy loss through constant opening.
AIR PURIFICATION Depending on the type of building, having effective air purification may or may not be possible. Most purifiers clean the air circulating in the room (not drawing in air from outside) so where possible the building should be effectively sealed to reduce the amount of outside air that can be sucked in/ filtered air be lost. In order to be effective against smoke the filters need to be equipped with a HEPA (high-efficiency particulate absorbing) filter and active carbon filter.	CONSIDERATIONS Consumption is very much dependent on the size of the system and how much air it is designed to move. Purifiers with larger air volumes will filter the air quicker, but consume more power. Usually these units have a quick ramp to operating demand and stay at that level. So consumption will be the main limitation. Check an operating manual for the unit you are interested in using for more information.
SPACE HEATERS Although most bushfires take place in summer, there are many other reasons energy resilience may be needed in winter. Many gas heaters require electricity to operate, however issues around access to gas for heating are outside the scope of this guide.	CONSIDERATIONS Electric heaters will most likely require their own circuit and should be a planned part of the electricity demand, i.e. not bought and plugged in when needed. Similarly, reverse-cycle AC systems will need dedicated circuits and have similar consumption and demand profiles to cooling (see above).

ELEMENTAL HOT WATER HEATERS Can be used in combination with solar hot water, elemental systems use an electrical resistance element to heat the water. These systems can be effective when the storage tank is well insulated and reliability is needed. Both of these require a higher quality system, that can be more expensive than some of the other systems on the market.	CONSIDERATIONS Usually considered high consumption, although that consumption can be very easily mapped to take advantage of excess solar energy being produced. Being able to set a lower thermostat can reduce this somewhat.
HEAT PUMPS AND SOLAR HOT WATER Widely considered the most efficient heating options, they can be combined with other systems to also provide space heating. They are also very dependent on the right environmental conditions and don't replenish as fast as elemental systems.	CONSIDERATIONS Heat pumps have much lower peak demand, and their consumption is usually lower, but can be higher in the wrong conditions (though they will always work, just not quite as well). Speak to a local plumber about how well heat pumps work in your area. Solar hot water systems will always have lower consumption. However, as most have an element back up for when there is not enough sun, they can produce unexpected peak demand.
WATER PUMPS When town water could be affected by a natural disaster consider installing water pumps to use in conjunction with a water tank and potentially a sprinkler system (see table below). Water pumps will provide water pressure needed for showers, kitchens and washing machines. Because they are connected to the building's water pipes, the max pressure of those pipes should be taken into consideration. There is no point having a high pressure pump when the tap is connected with a low pressure poly hose. For this reason, it may be necessary to either downgrade the pump or upgrade some of the plumbing.	CONSIDERATIONS Although usually used intermittently, consumption should be based on the longest use case, such as running a sprinkler system or multiple showers. Many pumps have high peak demand spikes when they start. While these spikes are short, they put pressure on a stand alone system and should be taken into consideration by the person designing the system. Steps should also be taken to reduce the amount of start-up spikes by making sure that the pump is not over pressuring the system, or turning off and back on again regularly.

EV CHARGING	CONSIDERATIONS
Useful in and out of an emergency, the use case for an EV charging station may be something the community may consider for itself or for tourism. Charging stations come in all shapes and sizes and there are several companies that offer standalone systems that can be installed and operated by them. Due to high consumption and demand of charging an EV, a charging station will likely require a grid connection to charge effectively. There are options on the market for an EV to be charged by solar during the day and drawn upon at night for use in the building. Effectively turning an EV into an extra battery in an emergency. However, this is anecdotal, and more research would be needed.	The charger will consume the amount of power required to charge the vehicle battery. Most electric-only EVs have batteries between 30-100kWh and will charge within the hour. However, slow charging is able to stretch this out over several hours which will reduce the per hour consumption. Peak demand will depend on the type of charger installed. Ultra fast chargers can operate on three phase power and deliver large amounts of energy in a short time. The faster the charge, the higher the demand from the charger. If the charger is going to be available to the public, it should be considered how (if at all) the users will be billed for charging their EVs.
OTHER DEVICES	CONSIDERATIONS
Washing machine/dryer Toaster Kettles Stove/hotplate, consider plug in electric stove tops or gas camping stoves	These devices can vary in energy demand considerably between models and brands. While they are only used for short periods, this demand can add up if used regularly. Overloading of circuits can be an issue. It is important that not too many power hungry appliances are plugged into the one powerpoint (or its circuit) otherwise collectively they can create a peak demand that will overload the system. This is like in your home when running the coffee machine, toaster and kettle in the kitchen trips the circuit breaker.

Other equipment to consider

While not specifically required for a REC you may want to consider the following equipment in setting up your Resilient Energy Centre.

Comms - Satellite link & two-way radios

Access to communication is key in an emergency. It helps a community self organise as well as connect to the outside world. Having dedicated communications equipment means the community will be connected from the start of an emergency, but it will also allow for them to be included in an energy resilience plan by authorities.

Knowing what communications equipment will be used will allow you to plan for how that equipment will be powered and/or charged. Radios and mobile phones may not seem like a lot, but dozens of devices, charging multiple times a day will add up. A satellite connection too may require its own emergency power or a way to be prioritised when the common battery is running low.

- Satellite and internet (STAND from NBN, Starlink etc)
- 6-12 two-way portable radios and one base station
- Collection of charging cables and wall plugs for different types of devices.

Medical equipment

If a person in the community requires power for a medical device, the best solution is to use the communication equipment to request a medical evacuation.

However, on-site a certain level of first aid and medical provisions can be stocked for emergencies.

- AED/Defibrillator
- General first aid kit
- P2/N95 face masks

Water tank

Depending on the size of the community, a tank of minimum 20,000L should provide enough water for washing and bathing for a community of 200 people for a couple of days.

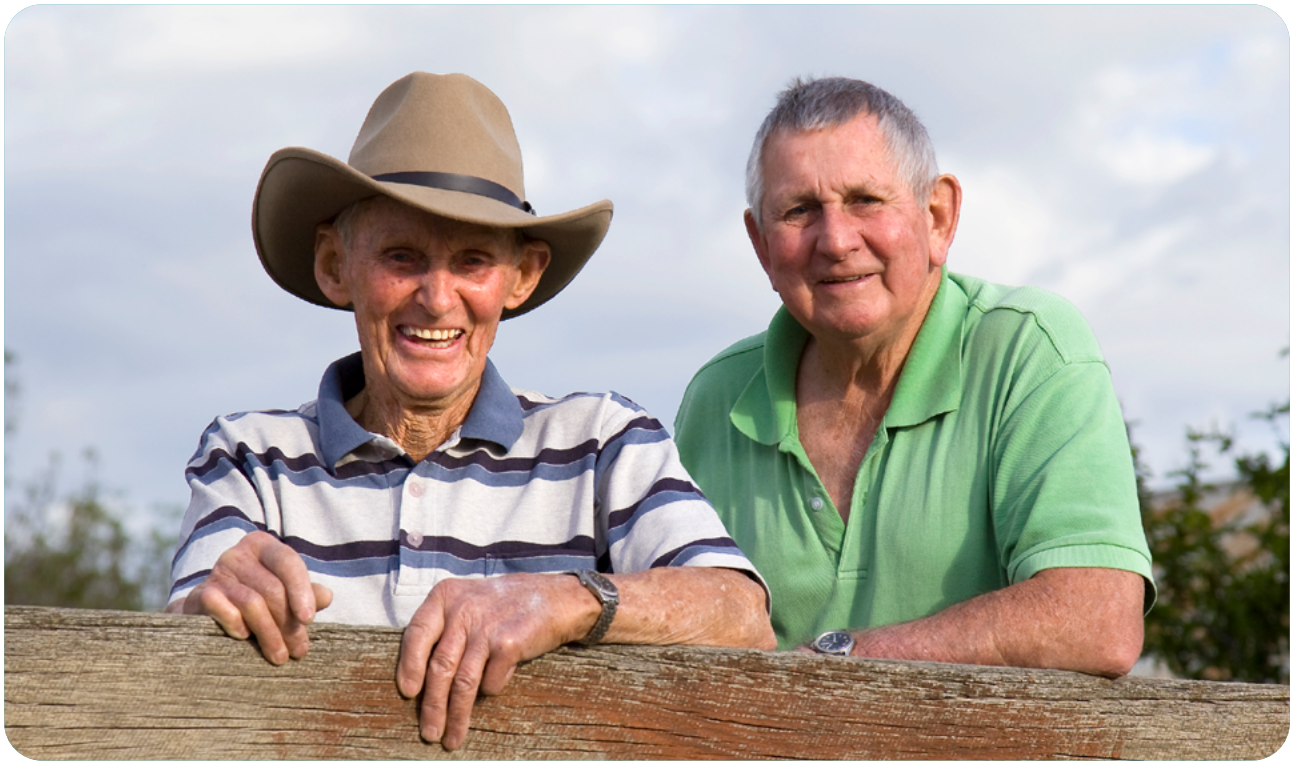
External Sprinkler systems and window mesh

As part of a defence of the building while the community is evacuated, you can think of extra measures to ward off stray embers and help ensure that the REC is available for when it is needed. Although the REC should be in an area away from bushland, this may not be wholly practical and extra measures can be taken to protect the building from fire.

Fire fighting equipment

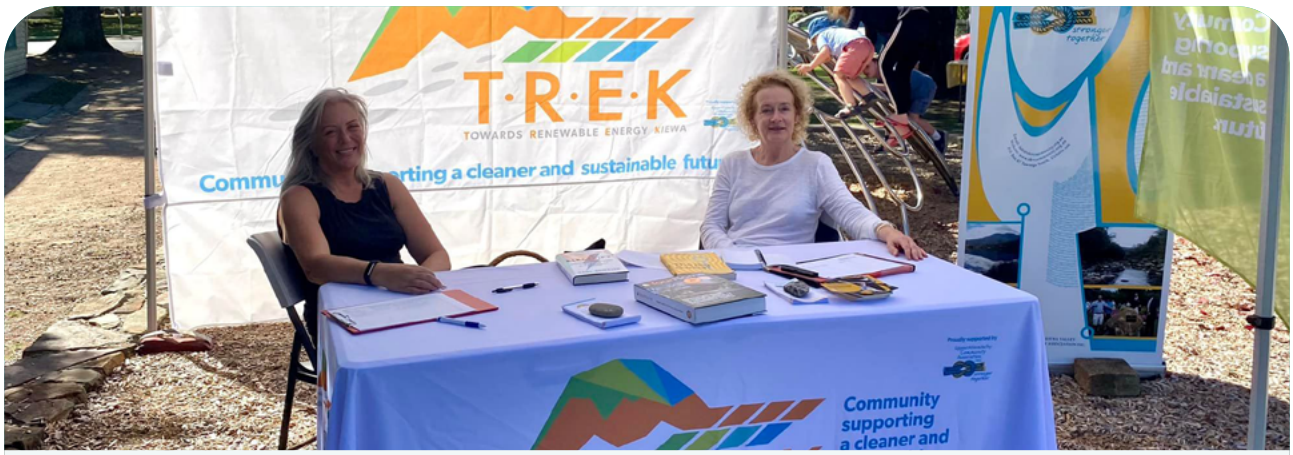
Although not a part of energy resilience, communities may find the site of the REC to be a good place to house communal firefighting equipment. For example an IBC tank with pump - remember to consider the energy demand of using a pump when calculating the energy generation required.

7. Case studies



the three case studies of energy resilience projects are good examples of what has been completed or are in progress around Australia. While they all include solar and various back-ups, the type of REC that the project has become as well as the location and the needs being addressed are all variable. This illustrates that each solution will be different and unique to the site and the community. It is important to take these case studies as inspiration for what is possible, not a template to replicate.

Some similarities between the projects are in their use of solar PV as the main source of power, but also that they include some form of fossil fuel generator. Another is their successful engagement with council and the local community in order to find a site, access funding and plan a project.



Toward Renewable Energy Kiewa (TREK) backup power at a safer place of last resort.

Location: Upper Kiewa Valley, Victoria
Funding: $200,000+ grants mainly from FRRR & Sustainability Victoria through the Hume Community Power Hub.

- 23.1 kW solar
- 33kWh battery
- Three phase diesel generator

Council owned building case study

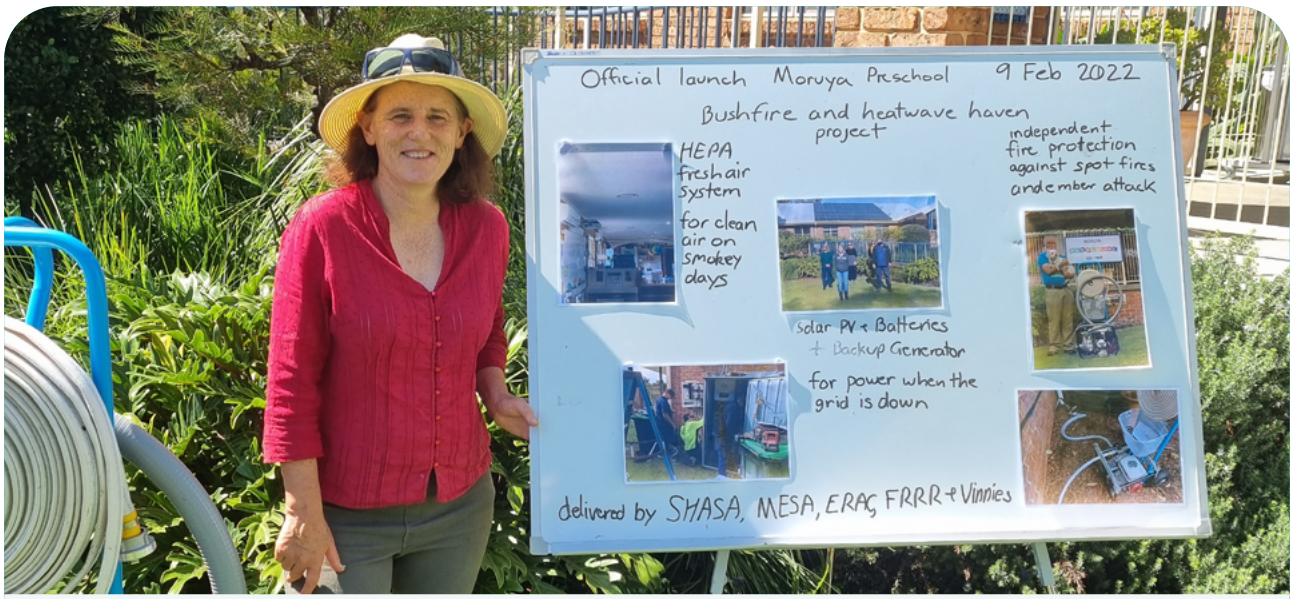
The residents of the Upper Kiewa Valley saw an opportunity to install some solar panels on the roof of their sporting complex in late 2018. As it happens the oval next to the complex is a 'safer place of last resort' and often utilised by the local CFA branch in times of emergency. This made it a natural meeting place for residents and officials to go for information and to provide vital services such as power for charging and cold storage. Support from both council officers and the local CFA was instrumental in the successful grant from the Foundation for Rural & Regional Renewal (FRRR). The installation is to be installed by council which requires a formal tender process due to be finalised and installed in late 2022. In the future TREK hopes to include an EV charging station on site and use excess solar to reduce the energy footprint of the pool located next door.

Lessons

- Grants require careful planning and management.
- Approvals for Council owned buildings are long processes.
- council staff may not always understand the concept or goal.
- Buildings that don't already have high energy demand may not be on everyone's radar for solar but could make great RECs.

Community outcomes in an emergency?

The place of last resort now not only services the immediate safety of the community, but also some conveniences that help them in weathering an emergency. In addition, the site will also support the CFA staff and volunteers by providing power for them to charge their equipment and rest in their down time.



Moruya Preschool / Kindergarten - with Southcoast Health and Sustainability Alliance (SHASA)

Location: Moruya, NSW
Funding: $25,000 from Foundation for Rural and Regional Renewal

- 9.8kW PV
- 11.6kWh battery
- backup generator

Privately owned business with community connection

The community at Moruya, along with SHASA received a grant to have a solar and battery system installed on the local preschool. During the 2019 bushfires, several residents and employees stayed at the preschool while their homes were under threat of fire. The ability to have reliable power during this time was a key stress for the local community and this was identified through a workshop discussion with Southcoast Health & Sustainability Alliance (SHASA), owners, employees and parents. Additionally, during normal operation the preschool is able to save on their electricity bills and should another fire threaten the community, staff and parents will have a safe place to charge their phones, store food and bathe.

Lessons

- No community has a one-size-fits-all solution.
- While previous projects by SHASA helped inform the conversation, it is not possible to copy and paste systems/designs to each new site.
- Groups must sit down and plan out what would work best for them.

Community outcomes in an emergency?

This site now will be able to give residents access to cold storage and phone charging during a prolonged outage or following a natural disaster. It also gives staff and families of the school access to a safe place during a heat wave or low air quality.

St Albans Hall council owned Hall operated by the St Albans School of Arts

Location: Hawkesbury, NSW
Funding: $500,000 across the Stronger Communities and Black Summer bushfire grants

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

Remote council owned community hall

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 presented a risk for both the 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 briefing that would not be in the way of the emergency response. The hall is also used by local clubs and rented to people outside the region for special events, so the upgrades chosen were meant to not only fulfil community needs in an emergency, but also make the hall more usable and economical to operate on a day to day basis.

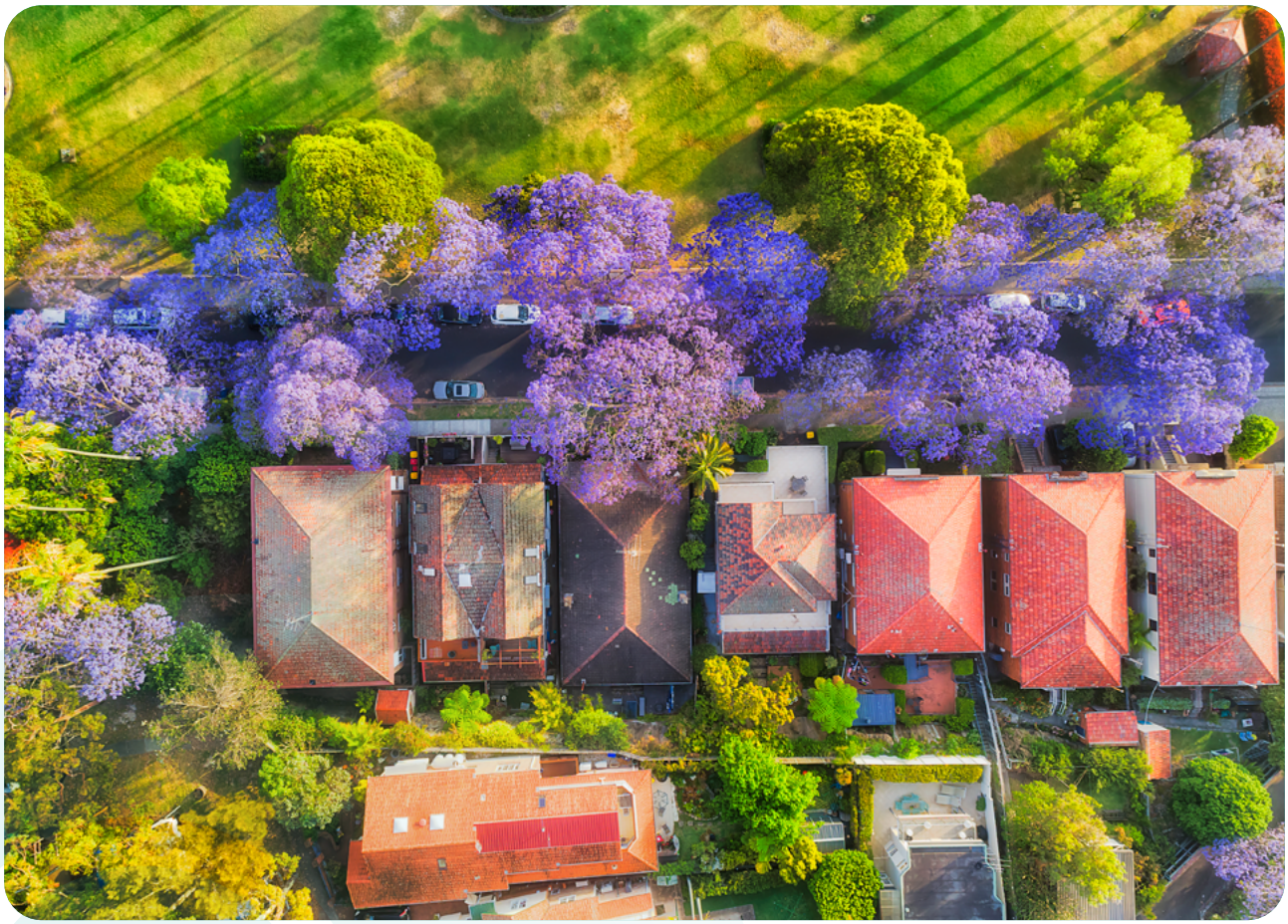
The upgrades were done in three stages: two separate grants by the community association and a grant from the local council to add satellite internet, fire protection and reverse cycle air-conditioner. The community has further upgrades planned and will hold a total of 8 events over 2022 and 2023.

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 caused inefficient spending. Once a project manager in the council was assigned to the project, coordination improved considerably.

Community outcomes in an emergency?

The community association is able to save money on electricity and reduce the hire costs of the hall for local groups. During an emergency, they have plans to have the hall as an information point for local residents to check in and coordinate.



8. How to fund a Resilient Energy Centre

There are three potential types of funding that correlate with different stages of a project.

- **Feasibility or early community engagement** - Funding may be required if it is not possible to find a free quote from an installer or the project includes technology that requires more research and modelling to see if it will function as intended. Community consultation is usually required before a project can be proposed, for instance to decide on an appropriate site and the community needs of the REC. In either case it may be possible to seek funding for these early stages through innovation programs or sustainability grants.
- **Capital expenditure and installation** - the most common area of grant funding, this will require a quote or estimated cost of the equipment being funded. While this mostly pays for the cost of purchase, it is important to include a budget for a project manager, events and other organisational activities as part of the installation to be funded by the grant.
- **Ongoing community activities and system maintenance** - Depending on the purpose of the REC, funding may be available to maintain it in preparation for a natural disaster or fund ongoing events and information sessions as part of a broader resilience strategy.

Of these three, funding for ongoing operations and maintenance is the most difficult to procure and can potentially be addressed through revenue or savings of the system.

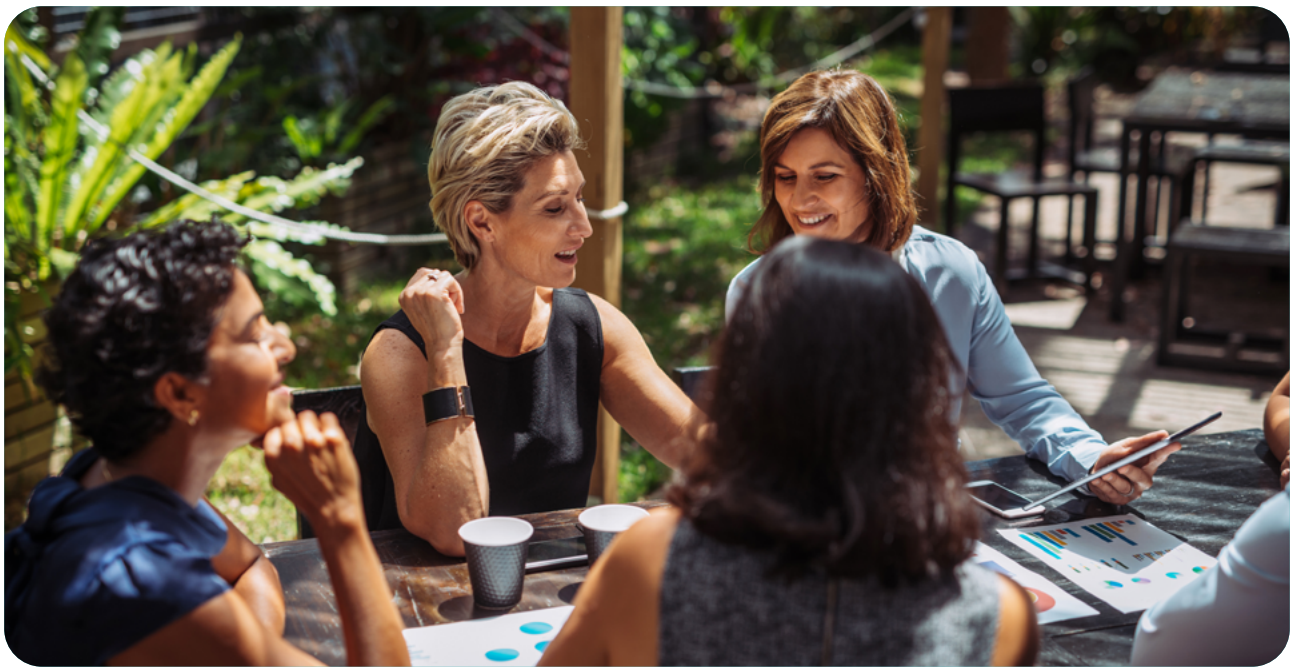
Sources of funding

Community donations and Crowdfunding

While structured very differently, both of these sources of funding are made up of lots of smaller contributions by a large amount of people. Akin to good old-fashioned fundraising this funding method fits with the ideals of community resilience, however can be time consuming as you will need to run an engagement campaign to raise awareness of the need for a REC and ask the public for the funds. Online crowdfunding platforms such as Chuffed or GoFundMe, have terms and conditions outlining their process, ensure your group understands these and plans who needs to be involved for a successful fundraise.

Arranging to conduct this type of fundraising through an organisation with DGR status will make donating more appealing, similarly think about finding a corporate donor to match donations.

For more information see their website here.



Philanthropy

Large donations can be a quick and simple way to fund a straightforward and urgent project. The donation can be in the form of money, or it could involve the donation of equipment, or services (i.e. pro bono work). All of these require a well connected networks to find and convince a philanthropic donor to support your community. Many donors will only be able to donate to organisations that have Deductible Gift Recipient status (DGR), so your community may need to be auspiced by another organisation.

Consider who you know within your community and ask about their networks and connections. Approach non-profit organisations focused on environment, sustainability, regional development or resilience that people in your community are connected to, they may have connections to donors willing to contribute to a tangible project such as a REC. These organisations may also be able to auspice your group if needed.

Government vs private grants

Along with state and federal government grants, private philanthropic foundations often offer grants for community development purposes. Both grants from philanthropy or the government will require some form of application process with a project plan. Government grants often (but not always) also include an end of project reporting requirements as well.

For the application process, grants generally require very similar things:

- A description of the project including the positive benefits
- A quote on the system costs, but also the administration costs of operating the project
- A list and description of partners, stakeholders and those working on the project
- Letters of support from a variety of partners or stakeholders
- Budget and timeline - including in-kind work to be completed by the community

TIP: Ask your Council Sustainability Officer or Asset Manager about potential grant opportunities.

Potential grant bodies include:

- Sustainability Victoria
- Department of Environment, Water, Land and Planning or other relevant State Government departments
- Lord Mayor's Charitable Foundation
- Foundation for Regional and Rural Renewal
- Sidney Myer Fund & Myer Foundation

Gifted equipment

A form of philanthropy is to receive gifted (or heavily discounted) equipment. It is important to work closely with the gift giver to ensure that what is being donated is truly what is needed. The equipment still needs to be recorded as a gift, similar to donations and the value recorded. Also consider that the equipment may also need to be stored. Large companies seeking to fulfil their corporate social responsibility goals may be interested in this. Consider reaching out to any companies your community is connected to.

A final word on funding

It is not uncommon for community projects to be a mixture of different funding models, part grant funded with the balance coming from crowdfunding. Sometimes funding the entire project can proceed in stages when funding permits. When seeking project funding it can help to describe the overall goal while only asking for smaller milestone contributions from funding bodies. Remember to celebrate your funding achievements!

9. Roles and actions for Community & Enabling Organisations

In developing Resilient Energy Centres there are many different people and organisations that will need to be involved. Perhaps the most important factor in exploring potential for and setting up a REC is to remember that we are all human, everyone is experiencing our new climate reality and facing their own challenges.

Being involved in a community project can be hugely rewarding and whilst you cannot create change alone, if you have a trusted, focused team who understands the issues that affect members of the community you can respond to many of these challenges together. This requires different people and organisations taking on clear roles to contribute to the project's development and success. Whilst the strength of RECs is that generally they are community led, staff and volunteers from other agencies such as the SES, CFA or council are available for support, contacts and technical advice.

Roles for community

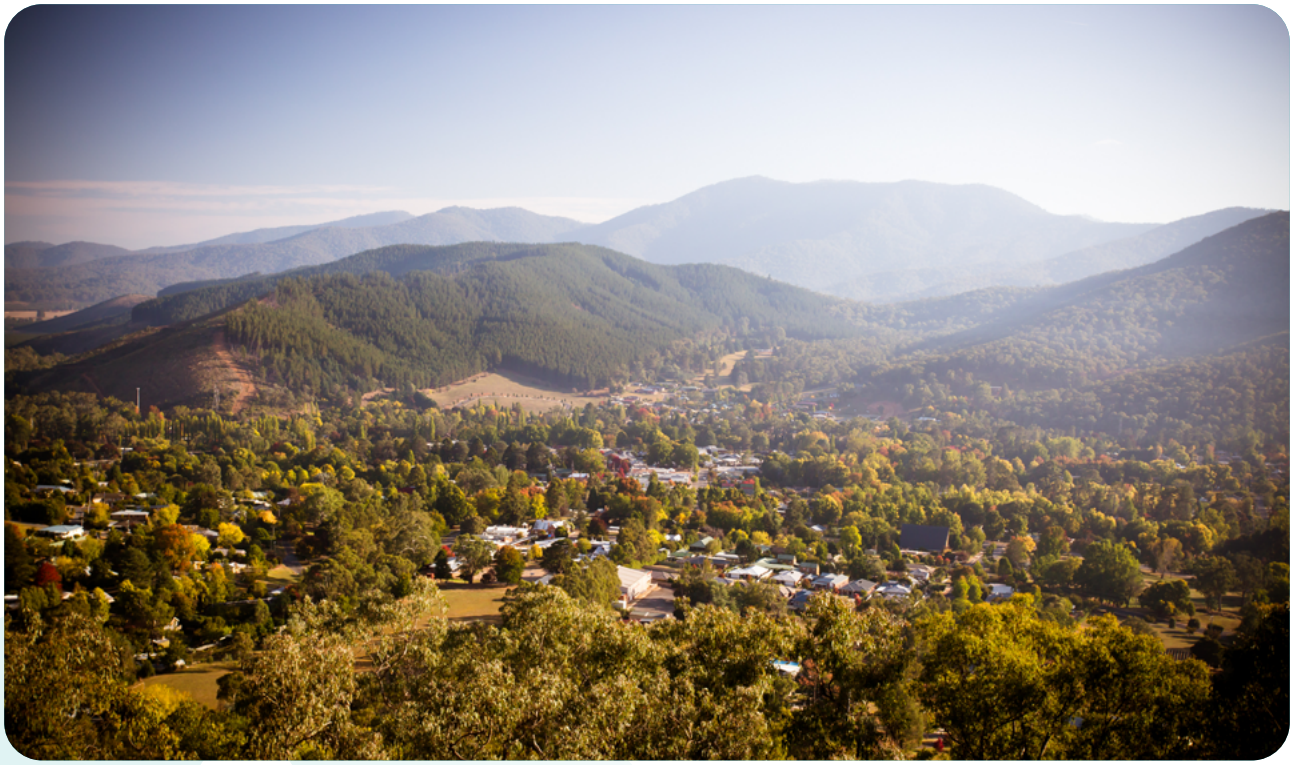
- Connect with and listen to the wider community to understand the issues that affect them.
- Organise community events to seek local guidance and identify/engage key community stakeholders.
- Identify/engage other important stakeholders and organisations, such as council officers and the CFA, who can champion and support the project.
- Find or establish an organisation/group that can drive the project forward and seek funding for your plans through donations, grants funds, etc.
- Develop connections with local renewable energy installers and tradespeople who can deliver the project to specifications.

Roles for Local and State Government

- Recognise that community members are seeking to help themselves and work to understand their needs.
- Identify and allocate staff/resources to support communities to develop RECs.
- Connect the community organisation with key stakeholders who can support the development of their plans, e.g. asset managers, grants officers.
- Share relevant information and policies with the community, such as council's emergency plan and a list of assets that could be assessed as locations for RECs.
- Provide practical support to community organisations through assisting with communications and marketing for events, venue hiring and catering for meetings etc.
- Provide grants programs and funding to help local community groups to develop and deliver their REC plans and installations.

Roles for other enabling organisations - e.g CFA

- Partner with and help communities to lead and develop their own plans for energy resilience. Regularly check in with them and provide assistance where needed.
- Help to facilitate community conversations and plans around emergency preparedness and response.
- Share information, ideas and knowledge that will be relevant in planning for RECs.
- Raise awareness of disaster events and risks as well as the experiences and lessons learnt from other natural disasters.
- Help with a stocktake of existing resources that are located within the community, such as generators and other machines.



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community power
agency