RESILIENCE FRAMEWORK

July 2023

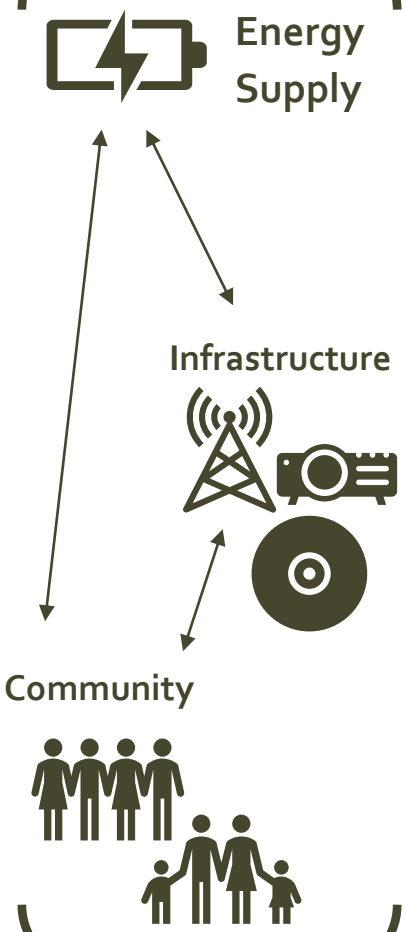
Community Resilience and Reliable Energy Feasibility Study for

Venus Bay and Tarwin Lower

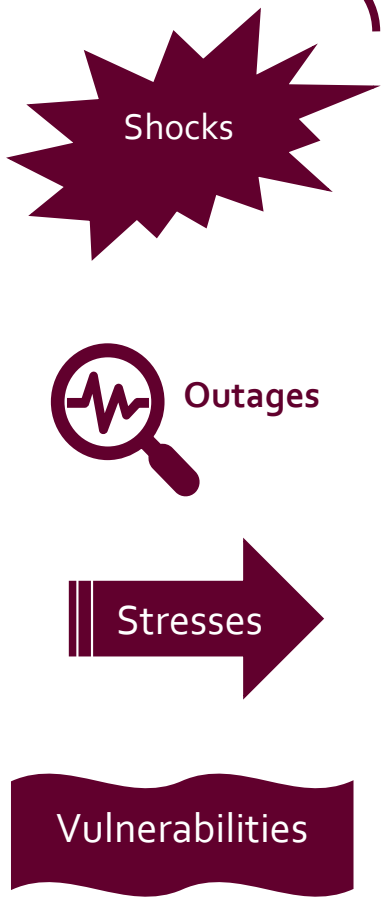
Australian Government
This project received grant funding from the Australian Government

Resilience Framework

1. Resilience of what?



2. Disturbances – resilience to what?

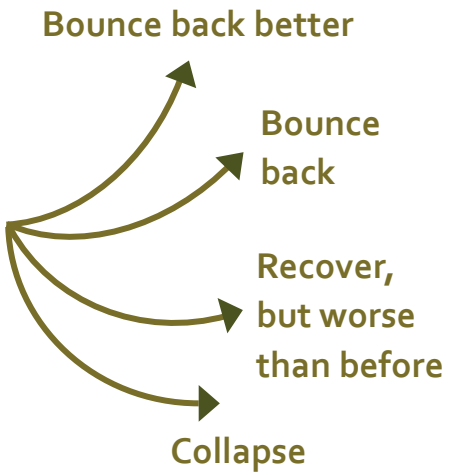


3. Capacity to deal with disturbance

What do you think?

- Being prepared
- Knowing who can help - connectivity
- Spare capacity, diversity, flexibility, alternatives / multiple options
- Adaptability
- Managing with less
- Support from authorities

4. Reaction to disturbance



5. Due to what actions?

Better = learning, adapting and transforming

Bounce Back = Preparation, monitoring, responding

Recover..ish = Coping, absorbing the shock but performance declines

Collapse = fundamentally changed by the event/s

Step 1 – Resilience of what?

Tarnagulla[1] used a capitals approach to building resilience. It identified its low economic capital before pointing to electricity supply as a contributing factor. Many frameworks focus on the social forms – eg communities and institutions in order to highlight those ideas that can be planned and improved. A repeating theme is that people's resilience relies on the connections between people.

The Venus Bay and Tarwin Lower project explored the resilience that can be increased with alternatives to the existing electricity supply. The framework therefore investigates these key issues:

a) We want this to be about *community* resilience

b) It focuses on *energy*

c) Other *infrastructures*, notably telecommunications and water cause significant problems when power fails.

We focused on these concepts and the connections between them

Workshop Design

Two of the workshop tables mapped social networks and Hubs and Clusters. The map that resulted highlighted the interdependence between the two towns – Venus Bay and Tarwin Lower. It was printed on a large sheet to provoke further discussions at community markets and engagement events.

In the second exercise participants were asked to classify all their energy use and dependence on infrastructure in three categories – Essential needs, Enough and Everything.

Full Results can be viewed in Harvest Report #1.

Important Energy *Users*

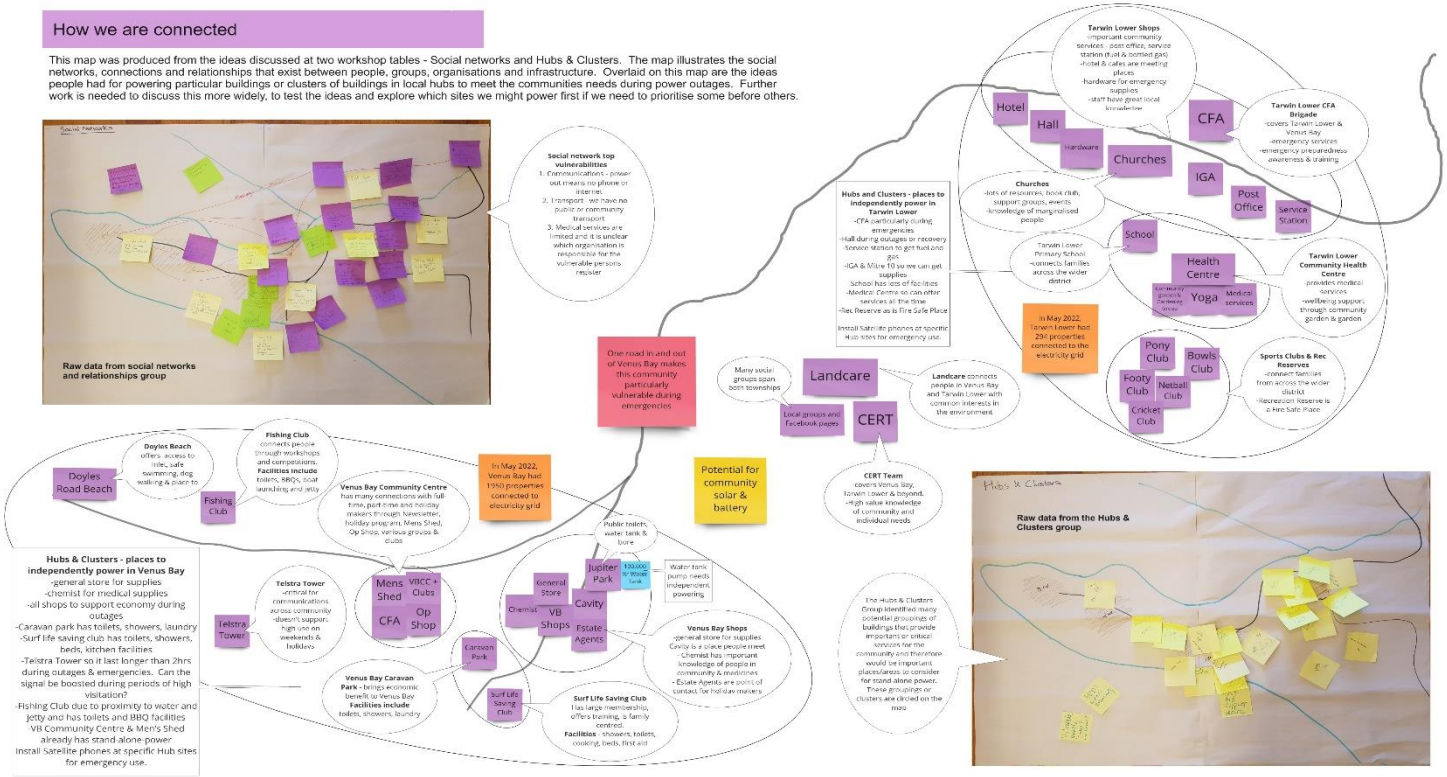
Community buildings, businesses are ranked most highly because if they have access to energy they can provide services to everyone.

Important Energy *Uses*

Feeling safe in emergencies, charging phones, light, water, petrol, money all rank highly.

Important Infrastructure

- NBN, mobile phone towers and EFTPOS.
- Drinking water
- Emergency services



Step 2 – Disturbances, resilience to what?

The Venus Bay project[2] started as a response to frequent power outages and the frightening black summer bushfires.

Needs during a disaster are different to needs during a more mundane power outage, as are the opportunities to service those needs. Exploring the difference is essential because safety is one of the highest priorities for a community when discussing resilience. Many frameworks are defined by emergency settings but, like Tarnagulla, Venus Bay wants to improve its everyday outlook as well.

Many resilience frameworks discuss stressors, sometimes from the perspective of long slow climate challenges. Stress as a frame provides on opportunity to discuss the changes in energy systems that could catch Venus Bay and Tarwin Lower ill-prepared.

Resilience and vulnerability are linked. Vulnerability therefore provides a provocation for thinking about priorities for change.

Fires and Floods

Venus Bay and Tarwin Lower are within a priority region for bushfire risk. Electricity supply is via a single line from Inverloch which frequently fails due to its susceptibility to bushfires, storms and high winds. In response to the 2009 Victorian Bushfires Royal Commission recommendations, Ausnet Services is now required to isolate some parts of the electricity network during bushfires. Channel flooding across the access road to Tarwin Lower can easily leave the community isolated.

Outages

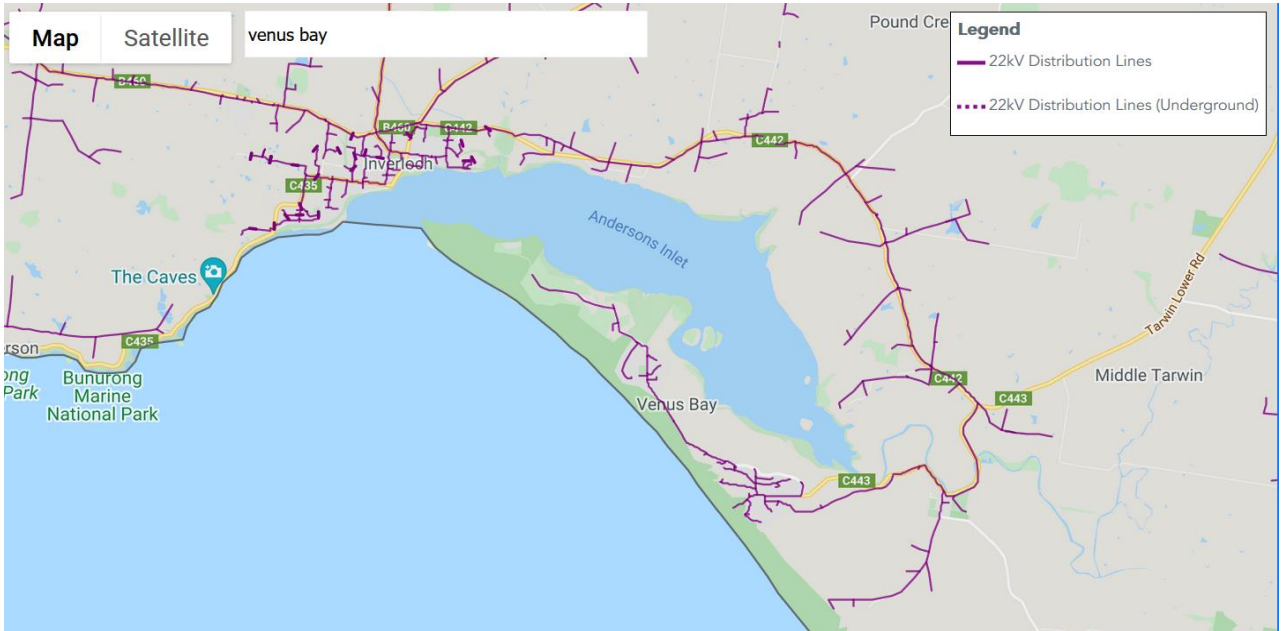
The community is served by a short rural feeder. Ausnet's average performance is to be less than 195 minutes per year. In the past decade performance has frequently been double this figure with a whopping 2,672 minutes in 2021.

A substantial analysis of outage data and costs based on Value of Customer Reliability appears in the neighbourhood battery study[3].

Vulnerabilities

- Single road access to 1950 homes on a narrow peninsula.
- A mixed demographic of permanent, part time residents and visitors means many people who can't participate in the energy transition are invisible in the community.
- LPG (bottled gas) supplements energy supplies in the community. A single petrol station in Tarwin Lower is the only source of transport fuel.

Ausnet map of Medium Voltage electricity supply to Venus Bay and Tarwin Lower.



Step 3 – Capacity to deal with disturbance.

Tarnagulla's capitals approach starts with capacity. Resilient systems display many of the properties that have been offered for starting the discussion:

- **Being prepared**
- **Knowing who can help - connectivity**
- **Spare capacity, diversity, flexibility, alternatives / multiple options**
- **Adaptability**
- **Managing with less**
- **Support from authorities**

Information, connections (between people, to assets, to information), resources and assets, governance and institutions are all common themes across the literature.

Biological systems' literature emphasises attributes like redundancy and diversity.

The community of Venus Bay and Tarwin Lower has capacity to respond to outages, so it will use this discussion to identify gaps.

Energy Options

Solar energy is abundant. Batteries and Backup generators can provide power at any time. Generators, however are not a renewable energy option. All three technologies work at the household scale right up to the whole community scale. Wind is also an abundant resource and might be an option at larger scales.

How a microgrid works

The Venus Bay Community Centre (VBCC) has installed a battery and a backup generator while expanding its solar system. This means the centre can be self-sufficient for energy and can operate during an outage – providing energy and services to local residents. The principles for operating a microgrid are the same for VBCC as for a larger system that could manage a whole street or a whole community:

- A disconnection point where the microgrid separates automatically from the grid,
- Adequate generation to maintain supply or top up a battery,
- Adequate control over energy use so that energy can last for longer and the system is not overloaded,
- A battery or generator (or both) that can operate when the generation is unavailable.

The full analysis of energy options and explanation of microgrid principles was explored in Workshop 2 – see Harvest Report.

The new battery installation at Venus Bay Community Centre.

Step 4 – Reaction to disturbance.

It is important to note that recovering from a challenge is often not the best outcome for a community.

Resilient is a word that suggests returning to normal with a minimum of fuss. Adaptable is a word that suggests ongoing change without losing some core essence.

Antifragile, tolerant, adaptive, robust, stable, durable are all words that are used and all mean slightly different things.

Exploring the way changes might affect a community and the types of changes that a community wants to embrace, allows the resilience discussion not to get stuck.

Impressions of recovery and restoration might be based on current or past expectations for Venus Bay. This concept of 'what doesn't kill us makes us stronger' ensures a framing of always preparing for Venus Bay and Tarwin Lower's future.

The electricity network ability to be restored lacks this element of "bounce back better" that microgrids offer.

Embracing the energy transition

Energy systems are undergoing significant structural change. Replacement of fossil fuels which are currently used for heating, cooking and transport means some systems will disappear altogether. Taking a clear-eyed look at the energy future is a "bounce back better" response because the Venus Bay and Tarwin Lower community has identified what it wants as its energy systems change.

A values-led approach to change

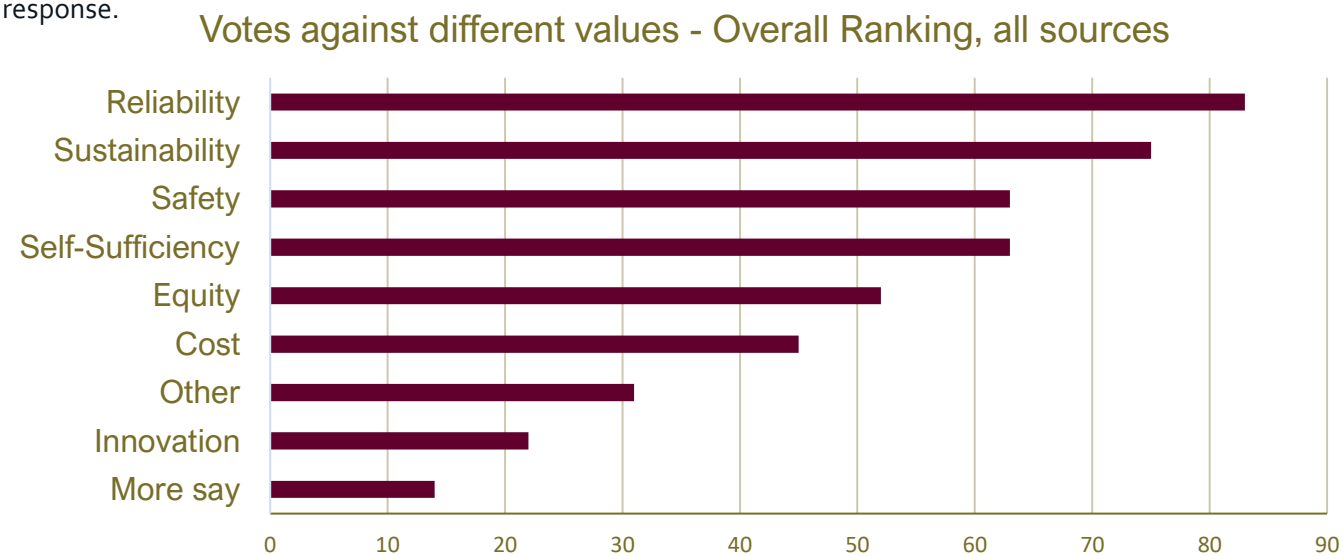
In Workshop 2 the values that should inform the energy priorities for the community were explored in detail. These were tested online and at the Tarwin Lower markets.

Results were reported back in Workshop 3 and used to inform discussions about energy pathways. Using the energy transition to build community wealth received an enthusiastic response.

Five pathways to follow

1. Households use the most energy and will need to use energy at different times of day – the household pathway is the most important.
2. Community organisations are the first place to improve community safety and access to reliable energy.
3. Businesses are the next largest users of energy and their services are valued.
4. Small clusters such as a street of homes connected to the same transformer may be the best scale for neighbourhood batteries.
5. In large clusters solutions can be developed to serve the whole community.

Harvest Report 2 and Harvest Report 3 provide the detail of the community definitions of each value and the pathways.



Step 5 – What actions can we take?

The Framework is adapted from the Department for International Development[4] but this final step has been added because the resilience literature suggests:

- If a community wants to bounce back better it needs to be perpetually learning, particularly after each event. And experimenting in order to test potential adaptations. Sometimes it needs to be prepared to fail which can be a form of collapse to clear the space for transformation.
- Bouncing back is often associated with preparation to minimise the impact of events, monitoring to predict events and speed response and the governance that formalises response procedures.
- Coping with disruptions and simply absorbing shocks is often associated with a decline in performance.
- Collapse means a system is fundamentally changed by an event and sometimes this is not a bad thing, but rather an important dimension to explore.

The action plan was developed in Workshop 4. A focus on transforming households, community buildings and businesses was complemented with a discussion about the coordinating structure that might be preferred for delivering an energy program/s. Underpinning this discussion were key targets:

- 4MW of local solar generation supplemented by wind if possible.
- Making all energy use, efficient.
- Embracing electrification of heating and transport, with some LPG equipment remaining for backup.
- 20% of energy consumption controlled to be used flexibly, especially during times of surplus solar.
- Additional control systems to ensure only essential loads are powered during times of limited power. (10-30% of normal energy use).
- 700kW of battery capacity with four hours of storage in the first stage of building local energy resilience.

Adequate generation

Additional solar is an abundant resource for providing enough local generation and can largely be installed on rooftops. The 4MW target will provide energy self-sufficiency for most seasons, including peak holiday periods with significant surplus generated during daylight hours. Winter remains a challenge with minimal surplus and more likelihood of storms which can lead to outages.

Adequate control and flexibility

Flexible use of energy could move over 20% of energy consumption into times of surplus solar and, in winter, times of cheap surplus wind on the energy market. The additional control and flexibility considerably reduces the size of battery storage needed to provide for essential needs in all conditions.

Adequate storage of energy

700kW of battery capacity with four hours of storage would be sufficient to underpin a microgrid design if developed after the flexible use of energy has been maximised.

This is one quarter of the size (and cost) that would be needed if efficiency and flexibility aren't implemented first.

Coordination and partnerships

Venus Bay and Tarwin Lower recognise that some entity may ultimately be needed to coordinate actions, but the best organizational form can evolve over time. Ausnet own the electricity network and need to be a partner in any microgrid implementation.

References

[1.] https://tarnagulla.weebly.com/ and https://knowledge.aidr.org.au/resources/ajem-january-2020-unpacking-the-meaning-of-resilience-the-tarnagulla-community-definition-comparing-to-the-literature/

[2.] https://www.vbcc.org.au/communityenergy

[3] Local Battery Feasibility Study for Venus Bay and Tarwin Lower: *prepared for Venus Bay Community Centre and project partners to develop Pathway 4 – small clusters and to support a grant application to the Neighbourhood Battery Initiative.* Report can be found at this link: https://www.vbcc.org.au/finalreports

[4] The framework approach is proposed in Department for International Development (2011a) 'Defining disaster resilience: a DFID approach paper.' London: DFID as used in Twigger-Ross, C. *et al.* 'Community resilience to climate change: an evidence review', p. 91.

All four workshop Harvest reports can be found at: https://www.vbcc.org.au/communityenergystudy

Final project reports are at: https://www.vbcc.org.au/finalreports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