

# C4NET

## Donald and Tarnagulla Microgrid Feasibility Study

Interim report for Department of Industry, Science, Energy and Resources (DISER)

February 2023

C4NET



CENTRAL VICTORIAN  
Greenhouse Alliance



## 1.1. Background

The Donald and Tarnagulla Microgrid Feasibility Study was launched under a Grant Agreement between the Centre for New Energy Technologies Limited (C4NET) and the Commonwealth of Australia, represented by the Department of Industry, Science, Energy and Resources (DISER).

The modern microgrid concept has gained increasing interest as a promising solution for energy systems that can deliver benefits such as energy security, cost savings, local generation, and consumption of clean, renewable energy. These are especially important in the context of regional Victorian towns such as Donald and Tarnagulla with supply vulnerabilities due to natural disasters (e.g., bushfires) and unreliable transmission/distribution networks.

This study includes 12 interdisciplinary projects with the goal to provide the community with potential alternative solutions to address their energy supply vulnerabilities, and more broadly to inform the relative community and power grid dynamics that would indicate value in exploring a microgrid solution more formally for any community.

The key unknowns that determine an existing grid-connected town's aptness to have a feasible microgrid are:

- the critical elements of the microgrid's design to suit the localised needs (both community and network)
- how the market rules would affect the microgrid and impact residents' choice of retailers; and
- to what degree is each local community united, engaged, willing to adapt and accept trade-offs that would be necessary in implementing a microgrid

## 1.2. Where are we?

In the past two years of the project, the research assessed the energy supply and future requirements in Donald and Tarnagulla by looking at grid and customer characteristics, demand peak, volume, events impacts, known constraints, and power quality. The hosting capacity of two townships were assessed within different scenarios (islanded or fully off grid) and combination of various generation/storage technologies.

To identify capacities, islanded or grid connected DER<sup>1</sup> configurations, design elements, optimal locations of microgrid assets, an islanding design and cost analysis was completed for each town. It was found that the grid connected option is the most feasible, sustainable, and reliable mode noting that replacing diesel generator by battery would not be economically feasible. According to the stakeholder impact investigation results, the configuration with PV, batteries, and diesel gensets best meets security, cost, and sustainability needs when security, reliability and quality are prioritised.

Following on the results from previous studies, a detailed Techno-economic and risk analyses was completed to understand the main benefits and costs to each stakeholder and whether a microgrid is commercially feasible for the different stakeholders.

Key findings include:

- The feasibility of microgrids and different operational configurations can vary by location i.e. microgrid may be an optimal energy solution for an area depending on the location, power grid systems reliability, community needs, DER penetration, and regulatory rules specific to the region.
- Running in islanded mode is significantly more expensive than running in grid-connected mode. However, system reliability is increased in islanded mode.
- Diesel generators were generally recommended as cost-efficient investment decisions due to relatively lower capital costs.
- Microgrids can be feasible in the event of severe bushfire or consecutive electricity blackout. Bushfire duration will impact the investment calculations significantly as result in more efficient microgrid in the event of bushfire. It was assumed that 2 events might happen during the life of 12 years. When not considering the impact of bushfires, required investment on PV systems is limited for both towns.
- Different microgrid ownerships were investigated in which the business models presented “DNSP-owned with third party operating lease” results as the most “balanced” commercial model where both the community members and the third party<sup>2</sup> benefit from setting up the microgrid while the DNSP sustains the capital costs for purchasing the microgrid DER assets.

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<sup>1</sup> Distributed Energy Resources

<sup>2</sup> Retailer or aggregator owned microgrid assets

**Project 49.11. Recommendations to regulators:** This project has started in November 2022 and is currently in progress. This project will identify regulatory and market barriers to microgrids, articulate the regulatory changes that might be needed to implement microgrids, and evaluate the potential impacts of making those changes. Investigating regulatory and market barriers to microgrids can open up opportunities for Donald and Tarnagulla whether to consider microgrid as an energy solution in case of any policy changes.

**Project 49.12. Microgrid assessment tool:** This project aims to develop a web-based microgrid assessment tool to enable different regions to understand how well-suited they are for adopting a microgrid model, and be able to answer key decision-making questions including:

- What does the region consumption model look like? what are the lows and highs, what is the forecasted consumption given historical data, and what are the costs and risks involved?
- would the microgrid suit the needs? and what would be the potential impacts?
- What are the available alternative microgrid options, what are the trade-offs including economic, environmental, and expectations?
- What is the impact of adopting microgrids on the critical business under different (major) events?

### 1.3. Progressed assessment of the feasibility of microgrids in Donald and Tarnagulla

This section provides a high-level overview of the projects and key findings completed in the last year of the feasibility assessment.

**Project 8 Economic and risk assessment:** University of Melbourne completed an economic and risk assessment. This project was performed in collaboration with Federation University to value the techno-economic risk associated with microgrid users for different planning alternatives and types of events (e.g., bushfires). During Project 8 the University of Melbourne developed a microgrid techno-economic assessment framework to analyse the diverse impact the microgrid will have on various relevant stakeholders. This includes economic impact, value, and opportunities created for all grid users, distribution network service provider, aggregators, retailers etc. during the economic assessment span.

Key findings include:

- Diesel generators were generally recommended as cost-efficient investment decisions but not recommended environmentally. The results showed larger diesel for Donald. However, when diesel generators were not considered as an investment option, investment in batteries significantly increased.
- Bushfire duration will impact the investment calculations significantly as result in more efficient microgrid in the event of bushfire. It was assumed that 2 events might happen during the life of 12 years.

- Savings arising from wholesale market arbitrage is the main source of revenues for the microgrid during normal operation.
- The NPV1 analysis points out that the microgrid project in Donald can provide further value.
- Different microgrid ownerships were investigated in this study. Among the business models presented “DNSP-owned with third party operating lease” results as the most “balanced” commercial model where both the community members and the third party benefit from setting up the microgrid while the DNSP sustains the capital costs for purchasing the microgrid DER assets.
- Although the option of having community members directly purchasing the DER assets may be financially feasible, the preference towards having the DNSP as an investor is further supported by its considerably lower cost of capital than the other actors under consideration, and particularly the community members.
- Network tariffs charged at microgrid-level can incentivize the cost-efficient use of the network, yielding to savings while the microgrid provides different technical benefits. The use of microgrid level tariff + LUoS<sup>2</sup> was proposed in this project.

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<sup>1</sup> Net present value

<sup>2</sup> Local Use of System Charge is a charge levied by local providers to represent the discounted network costs of local flows. <https://www.energy.vic.gov.au/>

## 1.4. Assisting key utility providers to make informed decisions regarding microgrid feasibility-Public event in February 2023

In February 2023, Powercor, GWM Water and CVGA hosted a community event to discuss the most recent outcomes of the microgrid feasibility study. Active community groups lead to meaningful discussions on what is possible – particularly when over 70% of the town’s electricity consumption can be supplied by existing rooftop solar. The event held in Donald and around 20 people attended including project partners representatives (Figure 1). Key takeaways are as follows:

- The community has a great appetite for installing the microgrid and become independent to the grid.
- It was suggested to look for other energy solutions that might be more feasible to implement in Donald. In that case, it is better to start small and scale it up in the future.
- Currently, over 70% of electricity demand is supplied by solar PV.



Figure 1. Powercor public event in Donald.

## 1.5. What next?

The study is well on track and will be completed in mid-2023. The key focus of the study will be to consider the potential regulatory changes required to drive the economic, power and social outcomes sought and lastly develop a tool that would help any similar regional town understand how well-suited they are for microgrids from the analyses performed in this study.

C4NET is planning to run a workshop in June 2023 to maximise the community insights into the feasibility study, present the final findings and reinforce the need for reliable energy solutions in regional Victoria.

For more information, visit:

<https://c4net.com.au/projects/donald-and-tarnagulla-microgrid-feasibility-study/>

Please see the 'Milestones' tab for the project status and final reports:







C4NET

Centre for New Energy Technologies Ltd  
ABN 56 626 202 480

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Centre for New Energy Technologies Ltd | [E: info@c4net.com](mailto:info@c4net.com) | [C4NET.com.au](http://C4NET.com.au)