TOTALLY RENEWABLE
YACKANDANDAH

Community Report
100% Feasibility Study Outcomes

2021

ACKNOWLEDGEMENT OF COUNTRY

We acknowledge the traditional custodians of the lands on which we strive, the peoples of the rivers and the hills of the Goulburn Murray region who walked these lands for generations. We pay our respects to the elders of the past, and the speakers of the first words, who lived in harmony with this country.

We acknowledge the elders of the present, who seek to regain their culture, and to teach the elders of the future their law, their history and their language. We pay our respects to them and extend that respect to all Aboriginal and Torres Strait Islander peoples today.

We honour their spirit – and the memory, culture, art and science of the world's oldest living culture through 60,000 years and more.

Yackandandah Creek

Table of Contents

CONTENTS

INTRODUCTION

TRY is a volunteer run, award winning community group with the goal of transitioning Yackandandah to 100% renewable energy. The 100% Feasibility Study examined Yack's current and projected energy usage and analysed the best way to get to 100% renewables.

TRY's record has been cemented via multiple hot water, solar system and battery offerings, three microgrids, a Virtual Power Plant of 210 properties, including 10 community buildings with solar systems (and three with batteries), a 274 kWh community battery *Yack01*, an independent community energy retailer and social enterprise *Indigo Power*, and a 58% solar installation density on Yack rooftops.

Despite having a 58% residential solar installation density, just knowing that doesn't tell us how much electricity we use now and in the future, how much is currently renewable, and what is the best way to get to 100%.

The federally funded 100% Feasibility Study has set out to answer that. It has taken a deep dive into Yack's data to look at how much electricity we use now, and are likely to use in the next 10-20 years, what are the options to generate and store renewable energy locally, how much will that cost, and what is financially feasible.

This report details the outcomes of that study for the community. These are big questions we're asking and it's a complex problem. The options this study examines will increase reliability in our local power grid, increase our resilience day-to-day and during times of emergency, help build our local economy, and reduce carbon emissions. The recommended option will set Yack up to better face whatever challenges come our way for the next 20 years.

Note that throughout the report, Yackandandah is often referred to as Yack.

January 2022

THOUGHTS FROM TRY

Driving towards 100% renewables seems like a big goal for a small town. But there is a clear rationale for why TRY has taken this path.

When TRY was formed in 2014, climate change was on the minds of some local residents. There was a strong desire to tackle the issue of climate change, but also a realisation that this could provide opportunities for the town via economic benefits and network reliability. We had positive plans that the community together could undertake transformative change.

For us, action was the solution. Technology provided a vehicle and an opportunity for TRY and Yackandandah to write their own script. To not be hostage to a partisan climate debate. And rather than using words to frame an argument, TRY has crafted a solution in actions.

The result has not only reduced the town's emissions, but saved residents money, lowered costs for community groups, given resilience to key facilities in case of power outages, and driven formative research on improving the reliability of the local grid and how renewables can be better incorporated into it. In so doing, we've demonstrated what can be done.

> "rather than using words, ... TRY has crafted a solution in actions

TRY Committee Members with the Premiers Sustainability Awards 2020. Photo: Sustainability Victoria

APPROACH

With funding from the federal government's *Rural and Remote Communities Reliability Fund*, TRY engaged consultants to undertake data modelling and technical and financial feasibility analyses.

TRY has used local organisations where possible to carry out this study, except where specialist services were required.

Mach2, a local consultancy in strategic, organisational and business services, coordinated the study and undertook the financial analysis. They performed the analysis and modelling of existing and projected energy use from de-identified electricity data. Data was obtained from the local Distribution Network Service Provider (DNSP), AusNet Services, the Australian Photo Voltaic Institute (APVI), University of NSW and the Australian Energy Market Operator (AEMO).

A project control group with representatives from Mach2 and TRY oversaw the project, identified potential sites and liaised with contractors, the funders and the public. Using local knowledge and a call for expressions of interest within the immediate Yackandandah area, four potential sites, giving five options to reach 100%, were identified for energy generation and storage facilities.

Tamar Hydro was contracted to analyse the technical feasibility for potential pumped hydro sites and Mondo for the technical feasibility of potential solar and battery sites.

Although a rigorous financial feasibility analysis was conducted, other important aspects were given significant weight and shaped the final recommendations. These aspects include the potential for 'islandability', environmental outcomes, and community acceptance.

Islandability refers to having an electricity supply capable of local operation when the broader mains electricity grid is unavailable. This can occur on an individual household level, a town level or a localised area level. Given Yack has been threatened by bushfire three times in the last 15 years, and used as a staging post for fighting the Black Summer fires in the Upper Murray in 2019/20, this is considered a highly valuable quality by local residents.

STUDY OBJECTIVES

To reach 100% renewables, TRY aims to progressively replace energy from non-renewable sources with new renewable energy generation and storage facilities and smart energy management. To achieve this, the objectives of the feasibility study are:

01

To analyse and model recent & future energy usage

By analysing three years worth of de-indentified consumption data from the DNSP, AusNet Services, and considering data from AEMO, the ABS, and the Australian Photo-Voltaic Institute (APVI), Yackandandah's future energy needs were modelled for 10–20 years.

02

Define what 100% renewables means in practice

There is a spectrum of interpretations of 100% renewables, some more challenging than others. The study explored a renewables target to meet Yack's energy demands that is both realistic and challenging.

03

Identify potential energy generation/storage sites

The study identified potential sites within the Yackandandah footprint and developed options for renewable energy installations.

04

To define the costs and energy capacity of the sites

For short-listed sites, the study defined the establishment and operating costs, energy yield capacity, and the extent and speed to which each can realise the 100% goal.

05

To assess the financial viability of each site

Each site has its financial viability assessed, together with the environmental benefits in terms of their impact on Yackandandah's greenhouse emissions and carbon footprint.

06

To identify community ownership models

The study addressed potential community ownership models for achieving the 100% goal.

07

To identify possible pathways to 100% renewables

The study summarised the identified options, their ability to enable Yack to reach 100% renewables and the costs of doing so.

Solar installation on the Yack Post Office. Photo: Luke Fraser, Solar Integrity

SCOPE

The feasibility study was limited to analysis based on known and established technologies and front-of-meter or grid facing options, as well as a geographic footprint determined by the local network structure.

Practical The generation and energy storage technologies addressed include solar generation with battery storage and/or pumped hydro storage. Although there are other potential technologies, the study focused on what was practical and affordable for Yackandandah. Smart energy control is assumed for the operation of a microgrid.

No wind generation We did a preliminary analysis of wind power and whilst there is some potential it was beyond the scope of the study. Evaluation of wind power opportunities can take at least 12-18 months. However its ability to provide a more even energy generation profile, complementing solar generation, and thus reducing energy storage requirements and cost, was discussed.

Front-of-meter The study was predominantly focused on considering front-of-meter or grid-facing solutions. This means energy infrastructure operated by an energy retailer or infrastructure provider on the network side of electricity meters (as opposed to behind-the-meter on private land).

Energy efficiency Consideration of energy efficiency measures was not included as part of the study. TRY has run efficiency programs and will implement a comprehensive program in the future. It is of enormous importance in optimising the way we use power and will enable the 100% goal to be reached more quickly and easily.

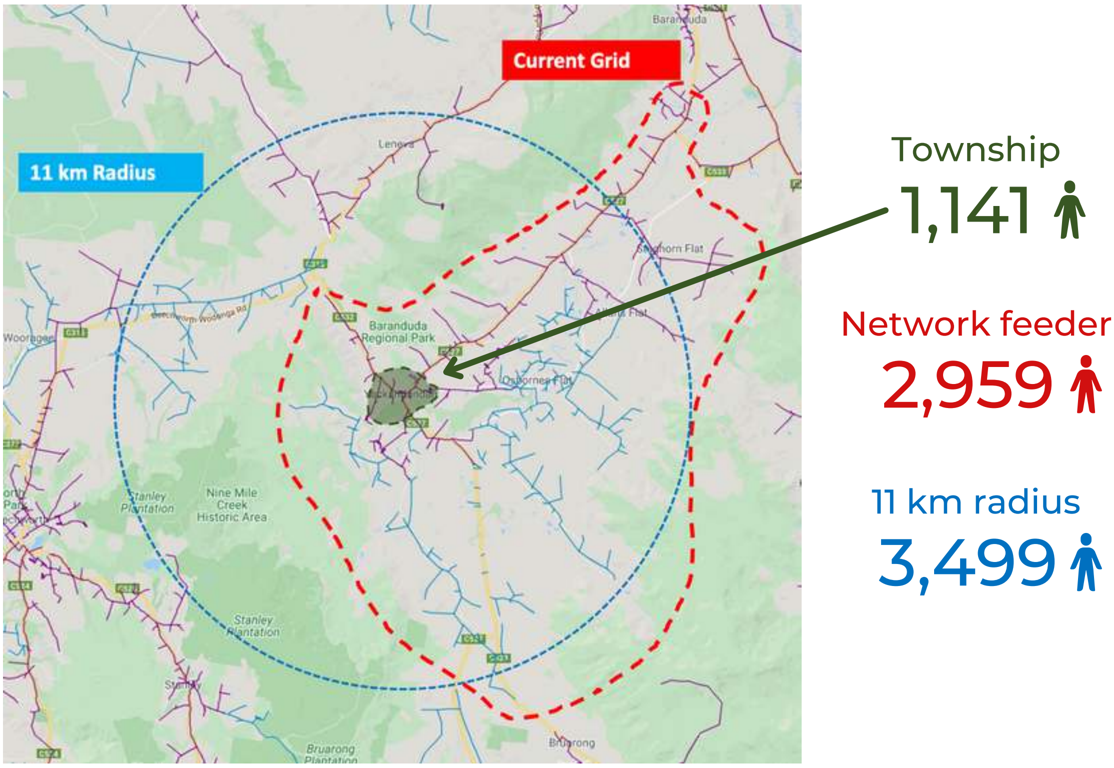
Behind the meter Exploring behind-the-meter (BTM) options was not within the scope of the study. TRY is already deeply involved in various BTM microgrid trials and significant learnings are already forthcoming from them. However, a brief overview of a BTM option is provided to compare to the options identified by this study.

Study geographic area

A target of 100% renewables requires defining the focus area. TRY has settled on a local area footprint determined by the electricity feeder that supplies all the local properties after the network meter at Patrice Vale on the Yackandandah Road. Establishing electricity facilities within that feeder area means the town could potentially be islanded, or continue to supply it's own power, if that single electricity feeder into the town experiences an outage.

Yackandandah Footprint

Blue and purple lines are the electricity lines that supply the town. The red dotted line encloses the only network feeder that supplies Yackandandah's power.



Like most regional Australian towns, a single electricity feeder supplies Yack. Data from that electricity feeder was taken from a High Voltage (HV) switch and network meter just outside the red dashed line on the map at Patrice Vale. All electricity imported into the Yack valley goes through this switch and meter, feeding the various 22kV and 12.7kV SWER distribution lines (blue and purple lines) that supply the Yack feeder area.

2,959 *people live within the network feeder area in 1,189 dwellings.*

Source: ABS QuickStats 2016

METHOD

To identify how Yackandandah might transition to 100% renewables the project team took data from various sources and analysed and modelled Yack's current and projected energy usage. Several potential sites for energy infrastructure were identified and then a technical and financial feasibility analysis of those sites was conducted.

The first stage involved analysing how much electricity the footprint area had used over the last three years and how much was already renewable, whether from locally generated rooftop solar or the proportion of renewables already in the Victorian grid.

The baseline data from AusNet Services used in the analysis was 15-minute interval data of the electricity flow through a High Voltage (HV) switch on the Wodonga-Yackandandah Road. This data gave the total electricity imported into the Yackandandah footprint area.

The amount of locally generated solar electricity was estimated using data from the Australian Photovoltaic Institute (APVI) and the University of NSW, in conjunction with PV generation data from AusNet Services. Together these sources facilitated a reasonable estimate of the amount of electricity generated by rooftop solar in the Yackandandah footprint area. This was then combined with the imported electricity data to give the total electricity consumption over the three year timeframe.

Using projections from AEMO, and a nominal likely local population growth, we then estimated how much electricity usage was likely to change over the next 10-20 years.

Method (cont)

The data informed the renewables target to aim for and the size of renewable energy installations, within the constraints of the sites identified by the study.

The sites were identified by a call for expressions of interest from the local community, combined with the local knowledge of the project control group and a list of site requirements from the technical partners, Tamar Hydro and Mondo. The technical partners were then tasked with conducting the technical feasibility analyses on short-listed sites. These analyses produced specifications and the cost estimates of building and operating the facilities.

All of that data was then fed into the financial analysis. This analysis used mainstream techniques such as capital and establishment costs (including grid capacity upgrades), predicted operating income, expenses (including asset depreciation), the profit/loss projections, and project cash flows (capital and operating), for the first 10 years. It also calculated the net present value (NPV) for the investment horizon and the levelised cost of energy (LCOE), both widely used capital investment tools for feasibility studies. The feasibility assessment was based on a project life cycle of 30 years and applied various assumptions including an annual CPI of 2%.

In addition to the financial analysis a broader holistic analysis was conducted on other benefits to the community such as islandability, contribution and timeliness towards the 100% renewables goal, and the greenhouse gas emissions impact.

The analysis yielded the 'viability gap' or the amount of extra funds required to make the projects commercially viable and guides the community on the amount of funds that would need to be raised to make the options a reality.

3 *years of de-identified electricity data and solar generation estimates were used to characterise Yack's energy usage.*

Data sources: AusNet Services, APVI and UNSW

Mark McKenzie McHarg presents energy usage analysis to the Yack community.

OUTCOMES

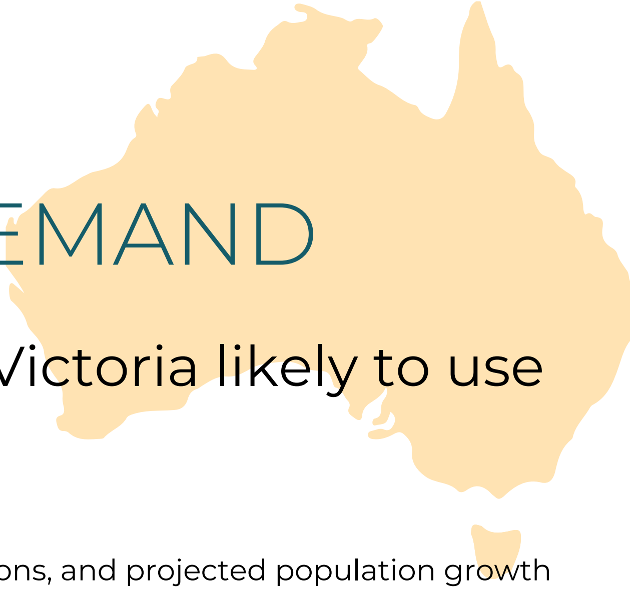
The feasibility analysis has produced a range of analysis outcomes – these are individual conclusions from the analysis process, which when considered as a whole alongside the community goals and constraints lead to the study conclusions.

Most outcomes are individual and unique to Yackandandah but also represent the broader trends and challenges occurring throughout Australia. As such they are worth considering by themselves, alongside the study overall conclusions.

The outcomes feed into the feasibility analysis of the the five site configurations which provide the **Options** for Yack to reach 100% renewables. Each option is described by its energy generation and storage capacity, establishment costs, the viability gap, islandability potential and the estimated time for Yack to reach the 100% goal. For other Option qualities such as individual costs, NPV, LCOE, or tonnes of CO2eq saved and their cost, please refer to the Feasibility Study final report.

By its nature this report is a small snapshot of the feasibility analysis, presenting the significant outcomes that inform the study conclusions.

The next six pages give the outcomes of the analysis in six key areas. These then informed the modelling and further analysis that give the resulting **Options** detailed on the seventh page.



NATIONAL ELECTRICITY DEMAND

How much electricity is Victoria likely to use over the next 30 years?

By looking at detailed AEMO data and projections, and projected population growth by the Australian Bureau of statistics, we examined the likely local electricity demand.

01

Overall demand

Overall electricity demand in Victoria is expected to grow between now and 2050 by 19,391 GWh or 46%

Source: AEMO

02

The next 10 years

Over the next 8-10 years, increases in Victorian demand of 1,808 GWh will be met and exceeded by new rooftop PV generation of 5,876 GWh

Source: AEMO

03

Demand per person

Electricity consumption per person is expected to decline marginally over the next 8-10 years and then increase by ~1% per year on average when EV use starts to grow

Source: AEMO

YACKANDANDAH'S ELECTRICITY USAGE

How much electricity is Yackandandah using and how much is renewable energy?

Using 15-minute interval data from 2019-2021, from the network meter on the Wodonga-Yackandandah Road, and estimated solar generation data from UNSW, we analysed Yack's recent electricity use and modelled what it's likely to be in the future.

04 Yackandandah's average usage

Australian households use an average of 17 kWh of electricity each day. In Yack, 35 kWh per property is used each day, but this includes big users such as the supermarket, health service and water treatment plant that skew the average. There is an average Yack load across the whole year of 1.7 MW, and a maximum of 3.1 MW that occurs in mid-winter at around 1 am.

Source: AEMO & AusNet import data

Yack generates **37%** *from rooftop solar*

05 Yackandandah's solar generation

Of our total use, we currently generate 37% from solar PV on our rooftops. That's high compared to the average across NSW/Qld/Vic/Tas/SA which is 7.7%.

Source: AEMO

06 How much of that is renewable energy?

Taking into account the amount of renewable energy currently in the Victorian grid, and the proportion of people that purchase green power, Yackandandah is currently using about 60% renewable energy.

Currently **60%** *renewables*

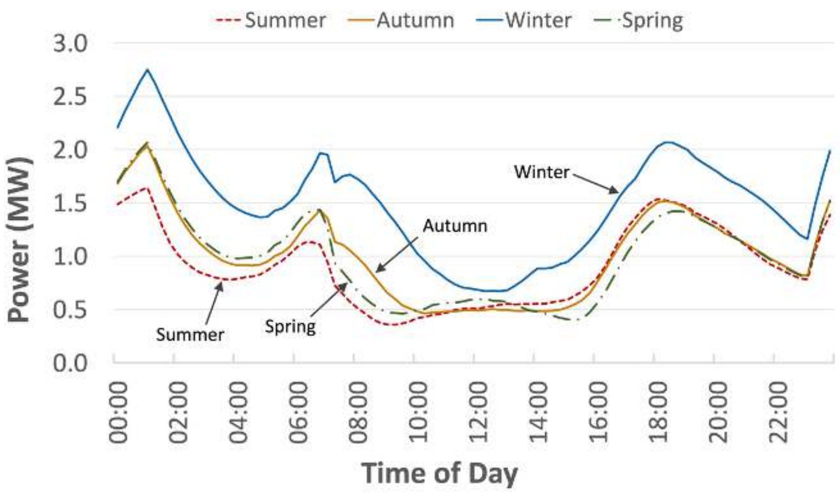
Source: Study analysis & Dept of Industry, Science, Energy & Resources

Yack's usage profile

Analysis of the de-identified 15-minute interval data from the network meter showed the daily and seasonal variations in the way that Yackandandah residents and organisations use electricity. As the data is from the network meter just outside the focus area, it does not include usage of solar electricity generated by rooftop installations within that area. This is why the profiles have a dip throughout the centre of the day. It is not that household usage is minimal then, it is that local rooftop solar generation is consumed and so less power is required from the main grid.

Electricity imported into Yack

This chart shows the seasonal daily average power imported into Yack, via the electricity feeder that supplies the Yack focus area.



2.2

average number of people per household

58%

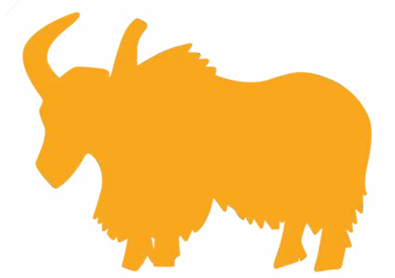
of rooftops in Yack have solar panels

The main features of Yack's average imported electricity profile are:

- highest peak occurs at 1 am as traditional electric hot water services (HWS) turn on
- there is a flat section through the middle of the day as local rooftop solar systems supply power that is used, and so less power from the main grid is imported into Yack
- there are secondary peaks at the start and end of the day, when solar generation is negligible, as households start their day or get home from work and school
- there is higher usage through the winter months – Yack requires more power to heat than to cool households – as would be expected for our climate

37% *of Yack's current usage is generated by rooftop solar installations*

YACKANDANDAH'S GROWTH



Is Yackandandah's energy use and generation growing?

Further analysis of the 15-minute interval data and the solar generation data, showed how Yackandandah's energy use and generation has changed from 2019-2021.

07

Yackandandah's growth in usage

The amount of power Yackandandah uses and imports from the grid is growing. Yack's total usage increased by an average of 5.4% each year over the past 3 years.

Source: ABS

Usage is
⬆5.4%
each year

08

How do we compare to the rest of Australia?

Yack's rate of increase in electricity usage compared to the rest of Australia, even with our high solar uptake, is relatively high. Anecdotally this is due to both population growth and less people per household.

Source: various

09

How fast are rooftop installations growing?

Rooftop PV generation in Yack grew by over 14% each year for the past 3 years. The average size of a rooftop PV system in Australia is now about 8kW, but earlier installations are much smaller than this. Yack's rooftop installation density is now 58%.

Source: APVI data

Rooftop PV
⬆14%
each year

RENEWABLES TARGET: 100% NET

What are we aiming for?

A target of 100% renewable energy can mean several things, but the cost of achieving the various targets is vastly different. A 100% Net target is the starting point of a spectrum that extends up to 100% Gross as the maximum.

10

100% Net

100% Net target means that on average, we generate more electricity than we use. We still use the national grid (via the network feeder) to supply power when the sun doesn't shine, and export power to the grid when we have excess generation. It is the minimum and easiest target.

100% Net is *already* achievable

11

How achievable is 100% Net?

A 100% Net renewable energy target for Yackandandah is already realistic and **achievable by 2027**. This takes into account the natural growth in local solar installations and the increasing proportion of renewables in our national grid and doesn't require any additional effort.

Yack can get to **100% Net** by 2027

12

Can we get there faster?

If we build new generation and storage infrastructure, Behind-The-Meter (supplying a property before exporting), or Front-of-Meter (supplying directly to the NEM and often operated by a DNSP), then we'll get there faster. This gives other benefits: islandability (increased resilience), better network reliability, a local economic boost and brings down carbon emissions more quickly.

RENEWABLES TARGET: 100% GROSS

Can we aim higher?

Can we aim somewhere between 100% Net and 100% Gross and what would this take?

13

100% Gross

100% Gross renewable energy means that we would never import a single watt of electricity through the network meter on the feeder line from the mains grid, on any day or hour throughout the year. We could disconnect from the grid if we wanted to and operate the town independently.

100% Gross costs
10X
as much as options looked at here

14

How achievable is it?

It is extremely challenging and requires the installation of significant new and costly wind and solar generation, and storage assets that are of a scale well beyond those contemplated in this feasibility study. It would cost ten times as much as the options looked at here.

We can *reduce* the target by changing the way we use energy

15

Is there an achievable middle ground?

Absolutely. If we can naturally achieve 100% Net by not doing anything special, then anything we do gives us a faster result with more resilience and reliability, and places us between 100% Net and 100% Gross. We keep aiming as high as we can, take advantage of any new technology changes, and keep costs and emissions down with maximum local benefits.

ISLANDABILITY

Can we operate independent of the grid?

A key part of this study's scope was to examine whether new generation and storage infrastructure would allow Yackandandah to operate independent of the grid, particularly during times of emergency.

16

Islandability

Islandability means being able to temporarily 'turn off the switch' somewhere along the main electricity feeder into Yack and continue to operate independently for a period of time. This does not mean going 'off-grid' – a grid connection is still used most of the time.

Yack has been threatened by bushfire **3 times** *in* **15 years**

17

How achievable is it?

Islandability involves a range of complex governance, accountability, policy, regulatory, safety and compliance issues. It's still worth working towards so that when we work out all the issues, we can do it. In the mean time, we can make community facilities islandable in times of emergency by providing them with batteries.

Islandability improves **reliability** *of supply and* **resilience** *in emergencies*

18

What other factors are there?

To achieve islandability, we might need to install grid-facing back-up diesel or hydrogen generators to meet extended low solar generation periods. These can also be powered by biodiesel which is considered carbon neutral. Including wind generation in addition to solar generation would alleviate this significantly, as wind has a different and complementary generation profile to solar.

WHAT ARE THE OPTIONS?

The following six options were evaluated. None met the 100% Gross target and all met the 100% Net target.

Site	Cost / Viability gap	Islandability (hours at average load)
Site # 1: Myrtleford Rd Solar: 1.63 MWp Battery: 2.63 MWh	• $6.5M • gap $5.5M	1.5 hours (100% Net by 2025)
Site # 2: Allans Flat Solar: 2.25 MWp Battery: 7.4 MWh	• $10.7M • gap $9.2M	4.3 hours (100% Net by 2025)
Site # 3: Comm. Ck Solar: 3.45 MWp P.hydro: 10.0 MWh	• $15.4M • gap $13.5M	5.8 hours (100% Net by 2025)
Site # 4: Leneva A Solar: 6.0 MWp P.hydro: 8.0 MWh	• $18.2M • gap $14.7M	[4.6 hours – not in Yack feeder area] (100% Net by 2024)
Site # 5: Leneva B Solar: 6.0 MWp P.hydro: 30.0 MWh	• $18.8M • gap $15.3M	[17.4 hours – not in Yack feeder area] (100% Net by 2024)
Alternative Option Residential 250 x behind-the-meter (BTM) solar & batteries (+ HWS, 2 x gensets, energy effic.)	• $4.9M • gap $4.9M	~4 hours (100% Net by 2023)

DISCUSSION

The feasibility analysis has produced a range of analysis outcomes – these are individual conclusions from the analysis process, which when considered as a whole alongside the community goals and constraints lead to the study conclusions.

A huge positive from this study is that Yack has already reached 60% renewables and generates 37% of its usage from rooftop solar, which is a fantastic achievement. The effort to achieve the remaining 40% renewables is significant but achievable.

During the study, a nominal population growth was assumed due to a lack of data – the 2021 census data is not due out until mid 2022. Anecdotally, the growth in electricity use of 5.4% per year is thought to be made up of both population growth and the decreasing number of people per household, as well as some increase in usage of appliances such as pool pumps.

The viability gap is the amount of funds that would need to be sourced via grants, donations or other means to make the projects commercially or economically viable. This does not take account of the value that increased reliability of the town's power supply during times of emergency (and more generally) would provide.

The Yackandandah valley is dominated by high quality agricultural land and small lifestyle properties. This makes it difficult to find a suitably sized piece of land, with the right parameters, at an economical price. The opportunity cost of the land is high and larger pieces of land, which would provide better economies of scale via larger installations, are not available.

Most of the examined options are not large enough to allow the town to operate without importing electricity from the mains grid on any given day in a year.

Discussion (cont)

Site 5B is the only one that has that potential, and would allow Yack to run without grid imports for 135 days/yr, but because it is not within the Yack feeder area, islandability is not possible.

There is an Alternative Option that is included at the bottom of the options table, Behind The Meter (BTM) solar and battery installations. This involves continuing the town's existing strategy of promoting solar system and battery installations on individual households, businesses and community buildings, and replacing electric resistive hot water systems (HWS) with efficient CO2 heat pump systems.

If this was subsidised on 400 properties, combined with two or three community batteries, two backup generators for the town, and a concerted energy efficiency program, a similar outcome could be obtained to that of building community-scale infrastructure.

This alternative would be cheaper than any of the surveyed options, does not require large areas of land, would be quicker to implement and require less regulatory and network hurdles, while providing similar outcomes to the surveyed options: increased network reliability, emergency resilience, and a modest islandability capability.

As technology develops, it also allows the town to flexibly adapt and augment the systems already in place, to improve the local electricity network and increase the islandability capacity, without large infrastructure upgrades. It does not preclude future front-of-meter generation and storage infrastructure and in addition, gives resilience to facilities within the town in case of internal network failures.

The financial analysis of the five main options indicates that none are commercially viable without significant grant or philanthropy inputs (minimum $5-8 million).

? *What is the best value way that Yack can reach 100% and provide resilience and reliability?*

Yackandandah township showing the main street and the supermarket with solar panels

Discussion (cont)

The main factors in this are:

- relatively high capital costs (due to the relatively small scale of the proposals), including grid capacity upgrades;
- current and projected low wholesale 'spot' electricity prices;
- predicted declining role and price of LGCs (Large-scale Generation Certificates) as a long term revenue stream for grid-facing renewable energy assets;
- and the volatility and uncertainty around ancillary services as a revenue stream.

The alternative Behind The Meter (BTM) option does not have to deal with these factors. It still requires significant grant and philanthropy inputs but is considered simpler and more achievable, and can be implemented in a staged manner.

By its nature, the financial analysis neglects the implicit value of increased reliability and resilience to the town and the significant environmental gains: emissions savings of 51,000 to 157,000 tonnes over the assessed 16-year project timeframe, depending on the chosen option.

Finally, there are a number of different ownership models that could be used to facilitate required infrastructure via community investment, including company structures, cooperatives, joint ventures, and mechanisms such as debt investment and equity investment. There are already working community energy examples within Australia, such as Hepburn Wind in Daylesford, Victoria, Shoalhaven Solar Farm in NSW, and SolarShare in the ACT.

This feasibility study has provided a detailed analysis of the likely technology configurations for Yackandandah to transition to 100% renewable energy with increased reliability and resilience, and the constraints, costs and benefits of each.

BTM vs FoM

Behind The Meter solar and battery installations provide an alternative to Front of Meter network infrastructure

The old Yackandandah sawmill (now Agency of Sculpture) during installation of 66 kW of solar panels and a 274 kWh BTM community battery

CONCLUSIONS

Given the restrictions on land availability and achievable scale, the feasibility technical report recommends developing a bespoke, multi-dimensional, Behind The Meter (BTM) approach consisting of solar and battery installations on residential, business and community buildings, along with community batteries, backup diesel/hydrogen generators and an energy efficiency program.

This is thought to provide the best value for money and be simpler to achieve. However, it is recommended that Front of Meter (FoM) options remain as possibilities subject to suitable funding. Other individual conclusions are shown below.

Renewables Targets

Options assessed here achieve:
- 100% Net and part way to 100% Gross

Islandability can be partly achieved by
- sites 1, 2, 3 and the BTM alternative

Technology

Suitable technologies include
- Front of Meter: solar, pumped hydro and battery installations
- Behind The Meter solar & batteries
- BTM are simpler and cheaper

Sites

Available land is limited which
- limits infrastructure scale
- makes islandability difficult
- FoM options lack economies of scale thus increasing cost

BTM with community batteries, energy efficiency and backup generators can achieve the target

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TRY is committed to assisting Yackandandah to generate, store and share renewable electricity, increase energy efficiency and achieve a 100% clean energy transition.

GLOSSARY

AEMO – Australian Energy Market Operator, a semi-governmental body that manage the electricity and gas systems and markets across Australia, responsible for monitoring electricity consumption and the flow of energy across the power system.

APVI – Australian Photovoltaic Institute, not-for-profit organisation providing data analysis, information, and collaborative research to support solar photovoltaics and related technologies. <apvi.org.au>

Battery – a chemical storage device for electricity, capable of storing and discharging power and being recharged repeatedly.

BTM – Behind The Meter, electricity generation or storage first supplying the property on which it is located and excess power potentially exported to the main electricity grid.

CO2 heat pump Hot Water System (HWS) – Heat pump water heaters absorb warmth from the air and transfer it to heat water (also referred to as 'air-source heat pumps'), in a process that is the reverse of a refrigerator. CO2 heat pumps are currently the most efficient retail heat pumps available.

DNSP – Distribution Network Service Provider, organisations that own and control the hardware of the electricity network such as power poles, wires, transformers and substations, that move electricity around the grid and supply power to homes and most businesses. <https://www.solar.vic.gov.au/dsnsps-what-are-they-and-why-are-they-important>

Electricity feeder – Feeders are part of the electric power distribution system that directly supplies to domestic consumers. They carry stepped down voltages from substations to distribution transformers, where the voltage is then stepped down further to supply homes and small businesses.

FoM – Front of Meter, electricity generation or storage which directly supplies and whose purpose is to serve the National Electricity Market for use by consumers.

Islandable supply – A supply capable of local operation even when the broader grid network has a power outage. To be islandable, batteries must be configured and approved to operate this way when they are installed.

Islandability – the ability to power a property or microgrid with a local power source independent of the National Electricity Market supply, for a period of time.

kW – kilowatt, the rate at which energy is transferred, an instantaneous measure of how much electricity is required to run something (a unit of power).

kWh – kilowatt-hour, the amount of electricity produced or consumed in an hour (a unit of energy).

kWp – kilowatt-peak, the amount of electricity produced under optimal conditions

Microgrid – A microgrid is a subset of the broader electricity network usually capable of operating independently of the network. <www.energy.vic.gov.au>

NEM – National Electricity Market, a wholesale electricity market in which generators sell electricity and retailers buy it to on-sell to consumers. All electricity sales in Australia are traded through the NEM. <https://www.aemo.com.au/-/media/files/electricity/nem/national-electricity-market-fact-sheet.pdf>

Solar PV systems – solar photovoltaic systems (solar panels) generate electricity from sunlight.

UNSW – University of New South Wales

VPP – Virtual Power Plant, collections or networks of electricity generation and storage with smart energy management, either renewable or non-renewable, providing stability and optimisation to electricity networks and consumers.

YCDCo – Yackandandah Community Development Company, a community-owned social enterprise.

REFERENCES

Technical report, 100% Feasibility Study 2021:

- Mach 2 Consulting, *YACKANDANDAH MICRO-GRID: Feasibility Study,* Final Report, RRCRF 000079, Yackandandah, Australia, October 2021.

References used:

- *AEMO 2020 Inputs and Assumptions Workbook - Version 2.1* (27-Nov-2020)
- AEMO Electricity Demand Forecasts, 2021
- AEMO Quarterly Dynamics Q2 2021, Quarterly Spot Prices, NEM
- AusNet Services import data 2018 - 2020, Patrice Vale meter.
- Australian Bureau of Statistics, *2016 Census QuickStats* (for Yackandandah, Osbornes Flat, Allans Flat, Bruarong and ~50% of Staghorn Flat)
- Australian government, Department of Industry, Science, Energy and Resources, Australian Energy Statistics, Table O3, *Electricity generation in Victoria*, by fuel type, physical units.
- Australian government, Department of Industry, Science, Energy and Resources, *Australian Energy Statistics by state and territory*, https://www.energy.gov.au/publications/australian-energy-statistics-state-and-territory
- Australian PV Institute (APVI), Solar PV Maps and Tools.
- Clean Energy Council, *Clean Energy Australia Report 2021*.
- Climate Council, *Fully Charged: Renewables and Storage Powering Australia*, 2018, report.
- University of NSW, Solar penetration data 2020 for Yackandandah (personal communication).

ACKNOWLEDGMENTS

TRY would like to thank AusIndustry for the funding that made this study possible and the volunteers who continue to donate their time to the infinite possibilities of an energy transition.

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We thank you for your continued support in our efforts to transition to 100% renewables.

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