BOUCHER CONSULTANCY

Community Solar Program Mount Helen Dr

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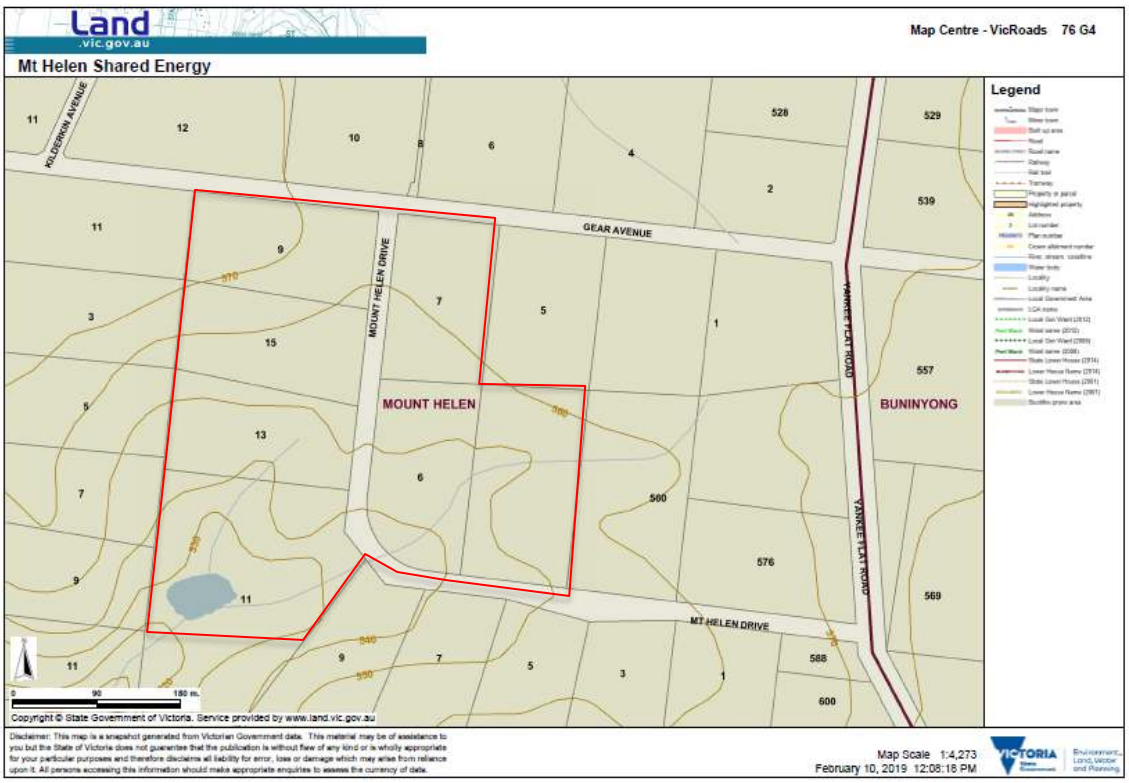
1. Scope

The aim of this report is to investigate various aspects of community solar and renewable energy mini-grid programs and apply these principals to a community solar project in Ballarat. Six residents in Mount Helen Drive, Mount Helen (off Gear Avenue), are seeking information to collectively generate and share renewable energy in a mini-grid configuration. This report will cover the following areas:

- Processes involved in boring and cabling under a public road
- Costs for boring and trenching 25mm solar cable
- Infrastructure and learnings from another mini-grid program (Mooroolbark)
- Open source legal documents available for solar panel roof leasing
- This project ran over the course of approximately 12 weeks. Just as the project was drawing to a close, a new entrant emerged in the electricity retailer market which allowed peer to peer electricity trading opportunities to be explored, so this was added to the scope of the project.



This picture above shows the location of the properties who have expressed interest in a renewable energy mini-grid program.

2. Boring and cabling

The City of Ballarat is responsible for the road infrastructure in Mount Helen Drive, Mount Helen. Mount Helen Drive has the following features:

- Classed as a 'municipal' road
- It is an unsealed road
- Speed restriction of 50 kph

The adjoining properties have the following features:

- Zoned rural living
- Bush fire management overlay applies to this area
- Environmentally significant overlay applies to some properties along Mount Helen Dr.

Planning Permits

Based on the evidence supplied, the City of Ballarat does not require a permit for boring under Mount Helen Dr.

"For the trenching works under Mount Helen Dr, the City of Ballarat would consider this a 'minor utility installation" [1]. The use of land for a minor utility installation is exempt from a planning permit under Clause 62.01. A Minor Utility Installation is defined under Clause 73.03 as "Land used for a utility installation comprising any of the following: e) Power lines designed to operate at less than 220,000 volts.). Provided you are not removing any native vegetation, no planning permit is required under the ESO5"[2].

Works within a road reserve permit

The City of Ballarat does require a 'works within a road reserve permit' to bore and cable under Mount Helen Dr. The following information must be submitted to council at least 2 weeks prior to the works being carried out:

- Log the works within a road reserve permit category at the e-services portal: https://eservices.ballarat.vic.gov.au/ePathway/Production/Web/Default.aspx?js=-125383774
- Attach a traffic management plan
- Attach a site plan showing all infrastructure

[1] Leah Slater, Statutory Planner, City of Ballarat
[2] Leah Slater, Statutory Planner, City of Ballarat

- Attach a certificate of currency for the contractor undertaking the trenching/boring
- Attach an agreement between households
- Attach a Powercor letter of approval

The cost to apply for a road reserve permit is $339.

3. Cost of boring and trenching

The following organisations provided estimated costs for boring and trenching 25mm solar cable. The contractors recommended boring as the preferred option due to the minimal impact on native vegetation and soil disturbance.

Ballarat Underground Boring

- http://www.ballaratunderroadboring.websyte.com.au/
- Located in Ross Creek
- Contact person - Brian Oakes
- $45 per metre for boring and trenching for 25mm cable
- Additional cost for 25mm cable
- Prices will be higher for ground with rock or shale
- Boring and trenching is the same price per metre

Pipe Pro Drilling -

- https://pipeprodrilling.com.au/
- Located in Ballarat
- Contact person - Jason James
- $2,000 per day for boring machine
- Mr James estimates that with a day under the road and boring to houses could be completed. The small boring machine can bore up to 120 metres and the large boring machine can bore up to 160 metres.
- An alternate cost is $25 per metre for 25mm cable trenching
- Additional cost for 25mm cable
- Quote will vary on the soil condition (rock, shale etc)

4. Mooroolbark Mini Grid

Project Aim

The Mooroolbark mini grid project was established in 2017 to research and measure the costs and benefits of a group of households in having their own mini-grid. The project was funded by the Demand Management Innovation Allowance. The project details were:

- Ausgrid approached 16 houses in an undisclosed street in Mooroolbark, Melbourne to participate in a renewable energy mini-grid program. 14 of the 16 houses agreed to participate in the program, 2 houses chose not to participate.
- All infrastructure was supplied free for participating households. At the completion of the program (30/6/2019) participants will keep their solar panels and Fronius inverter, however batteries and the management system will be removed from each house.
- The houses use natural gas for central heating and hot water.
- The cost of the program has not been disclosed.

The program had the following objectives:

- Reduce peak demand for the selected houses
- Provide electricity supply reliability
- Manage the impacts on local grid infrastructure through household solar uptake
- Ensure the mini-grid electricity generated is of a high quality (i.e. correct frequency and voltage)
- Reduce electricity costs to the customer
- Options to share and trade electricity between households
- Allow the 2 houses not participating in the program to run in off-grid mode and utilise the renewable energy from the other 14 houses.

Technology Used

Solar Panels – Participating houses received solar panels. The system size was between 3 kW and 4.5 kW. Solar panels were manufactured by JA Solar.

Inverter – A Fronius inverter was installed with each solar system.

Household battery cabinet – a household battery cabinet was installed in participating homes which consisted of:

- 10 kWh battery manufactured by LG Chem

- 5 kW Selectronic SP Pro smart inverter manufactured by an Australian company, Selectronic. The smart inverter communicates with the Fronius inverter and allows the house to operate in 'off-grid' mode.
- Air-conditioner in the cabinet to prevent the batteries from overheating
- a peak response unit made by GreenSync

Meter – A special smart meter was installed at each household which enabled financial offsetting of one household's solar generation against another household's usage.

Central Switching cabinet - is located at the end of the street and enables all houses to connect and disconnect from the main electricity grid. When disconnected, all 16 houses will receive electricity from the 14 household battery installations. See image in Appendix 1.

Central stabiliser - is located at the end of the street and consists of a 10 kWh Toshiba battery and 18 kWh 3 phase inverter. The stabiliser is manufactured by Powertec Engineered Solutions. The stabiliser operates when the LV switching cabinet disconnects all houses from the grid and all houses (including the 2 houses with no solar and batteries) operate in 'island' mode. The stabiliser ensures the quality of electricity in the mini-grid is maintained, by keeping frequency and voltage at required levels. See image in Appendix 1.

Micro EM cloud-based platform - Connects the houses and enables energy sharing between houses. The software is designed by GreenSync.

Project outcomes

- Each house can operate in 3 modes:
    - **Grid connected mode** – running off the main electricity grid
    - **Off-grid mode** – individual houses can run off-grid using their stored electricity in the battery but they still remain grid connected, should they need additional electricity.
    - **Island mode** – all houses operate independently from the main electricity grid. In this mode the houses will share electricity and the stabiliser will ensure the electricity is high quality (i.e. correct voltage and frequency).
- Successfully capture solar energy and use that energy in the evening. Utilising stored energy in the evening reduced peak demand for each house.
- Batteries were charged twice per day; overnight they were charged using cheaper off-peak electricity (11pm to 7am), and they were also charged during the day from the solar panels.
- Each resident could determine the quantity of power they exported to the grid and the quantify of power they kept in the battery.
- Participants were able to share electricity with other houses in the mini-grid.
- Every household was provided with real time energy usage.

- Participants responded to demand management network requests. Households either increased or decreased their power use to maintain electricity quality throughout the wider network.

Learnings

- **Customer knowledge** - Participants increased their support for distributed energy programs once they experienced their house operating in off-grid mode. Participants had a greater understanding of energy and engagement with the program. Participants also reported a strong interest in sharing electricity with their neighbours.
- **Energy cost reductions** – There were significant cost reductions achieved, with 80% of savings achieved from solar, and 20% of the savings achieved from the battery.
- **100% renewable energy** – Participants were able to switch all 16 houses to off-grid mode and run on 100% renewable energy.
- **Peak demand** – Peak demand was reduced by running households on batteries during the higher energy period.

5. Roof Leases

There are two organisations that provide open source legal documents for community solar projects:

Victorian Community Solar Alliance

Victorian Community Solar Alliance has several legal agreements that are available free of charge for community solar programs. There are two types of legal documents available:

- investment project information documents which provide information about community solar projects to potential investors.
- host site agreement templates are for a community solar organisation to establish an agreement with the host site for a community solar project.

These templates may not be suitable for the Mount Helen community solar program. The templates are for commercial sized systems with costs greater than $40,000 and the agreement wording cannot be altered.

https://www.communitysolar.org.au/support-for-csos/legal-documents-and-information/

Bendigo Sustainability Group

Bendigo Sustainability Group have several legal documents (power purchase agreements and roof rental agreements) that were recently updated by Community Powerhub Bendigo. They have offered these agreements to Community Powerhub Ballarat for an undisclosed fee.

6. Mini-Grid Advantages/Disadvantages

Advantages	Disadvantages
Ability to share electricity between households	Expensive to cable and connect all houses
Mini-grid allows individual houses to switch-off from the main grid and operate on 100% renewable energy	Some houses have shading issues throughout the day which will impact on solar generation
Possible funding opportunities	Some houses are high energy users and would benefit from energy efficiency programs prior to installing solar
	Batteries are currently expensive however prices are expected to fall in the coming years
	Mini grid would require support from electricity distributor (Powercor)

7. Community Meeting 12 March

A meeting was held on Tuesday 12 March 2019 with representatives from the Community PowerHub Ballarat (CPH) and the 6 householders in Mount Helen Dr. CPH provided information on the householder's current electricity consumption, return on investment for adding solar and batteries, and the estimated costs and infrastructure required to establish a renewable energy mini-grid.

The group concluded that a renewable energy mini-grid would be too expensive without external funding from a State/Federal Government or electricity distributor. The group were interested in peer to peer electricity trading as a cheap alternative to sharing renewable energy between households.

8. Peer to Peer Electricity Trading

Peer to peer electricity trading is an emerging market that allows solar electricity households to sell excess energy to non-solar households wishing to purchase renewable energy.

Currently, households with installed solar sell their excess electricity back to the retailer through a feed-in-tariff. The retailer then on-sells electricity back to the grid for a profit. Solar trading allows the householders to engage in the buying/selling transaction without the retailer being involved. The advantages of peer to peer trading are:

- Both the buyer and seller will benefit by reduced energy costs.
- A house unable to have solar can still enjoy the benefits of cheaper bills and utilise renewable energy.
- A household can elect to sell either their electricity at a discounted rate or provide their electricity for free to family, friends, neighbours, or even a nominated charity.
- Locally generated renewable electricity is shared and used with neighbours, as opposed to utilising fossil fuel electricity from the Latrobe Valley.
- Reduces costs by removing the energy retailer from the transaction process.

Energy Locals

Energy retailer, Energy Locals, was officially launched on 7th March 2019 and is aimed to match households who don't have solar, with solar electricity customers who wish to sell their excess energy. Currently the program is being offered in NSW, SA, ACT and southern Queensland. The program will start in Victoria in the coming weeks. Unlike other peer to peer programs such as Power Ledger and AGL Solar exchange, Energy Locals allows households to exchange energy without the involvement of the electricity retailer.

Energy Locals details

- Energy Locals require households to leave their current energy retailer and join Energy Locals. Their peak, off-peak, and service charges are like other energy retailers.
- A seller can nominate a friend, family, or even a charity with which to trade. The seller sets the minimum price they will sell excess electricity for, and the buyer sets their maximum electricity purchase price. Nominated trades must be accepted by both parties.
- Energy Locals does not profit from trades between households. They charge $4.50 per week fee for use of their Enosi platform.
- A seller is restricted in the price for which they can sell electricity. The current electricity price of 23 cents/kWh consists of wholesale (9 cents kWh), and network and environmental

(14 cents kWh) costs. A seller can only sell at a price above the network and environmental costs (i.e. between 15 cents/kWh and 22 cents/kWh).

- A buyer will agree to purchase electricity between 15 cents/kWh and 23 cents/kWh. Benefits to buyers include cheaper electricity rates and locally generated renewable energy.
- You can donate your excess electricity to a nominated charity or family/friend.
- If electricity is not sold to friends/family, your offer is placed in a selling pool and sold within the Energy Locals network.
- Electricity cannot be stored and traded later.

Further information is provided here www.energylocals.com.au

Other Peer to Peer providers

Power Ledger

Power Ledger is a trial program based in Western Australia which supports households to set their own prices and buy and sell excess solar energy. Power Ledger will collaborate with the energy retailer and these trades will appear in your electricity invoice.

Further information is provided here https://www.powerledger.io/

AGL Solar Exchange

AGL Solar Exchange is available for AGL customers who register with the program. A solar household can trade excess solar energy on the AGL Solar Exchange. A household without solar can trade with people who are generating more solar energy than they use.

Further information is provided here https://www.agl.com.au/solar-renewables/projects/solar-exchange

Appendix 1 – Mooroolbark photos

Picture above shows a diagram of the Mooroolbark mini-grid, the houses who have solar and batteries, non-participating houses, and the central stabiliser at the end of the street. All houses are connected to the grid but can operate remotely or as a whole in off-grid mode.

Each home has a battery cabinet with the following equipment:

A 5 kW Selectronic SP Pro battery inverter allows the house to disconnect from the grid and run the house on battery mode.

Greensync data control and communication.

10 kWh LG Chem battery storage.

Switching cabinet with circuit breaker and protection relay manufactured by EIV. This devise can connect and disconnect the 16 houses from the main electricity grid. Disconnecting allows the houses to operate in off-grid mode.

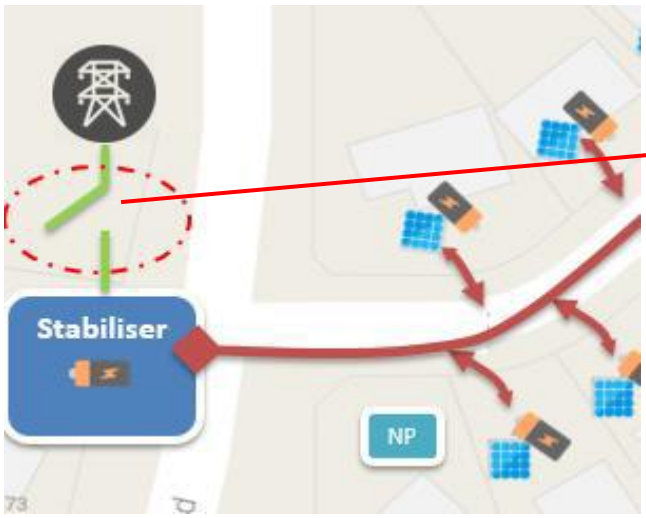
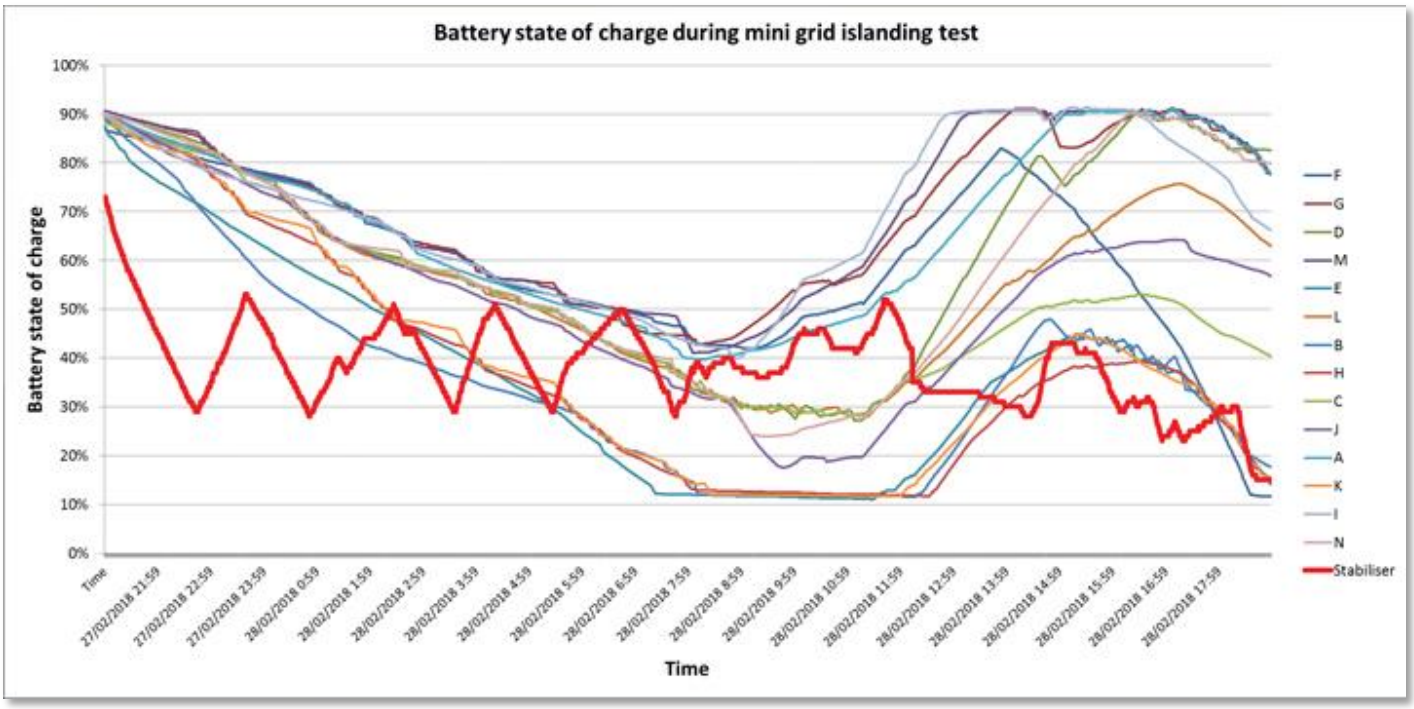


Image shows the switching cabinet disconnecting the 16 houses from the electricity grid

Battery levels in off-grid mode



On 28 February 2018, all houses were disconnected from the main grid and operated in 'island mode' or 100% battery power. The batteries were not charged overnight and 4 battery systems were fully discharged by 7am. The remaining 10 battery systems provided electricity to all 16 households between 7am and 10am. After 10am, the battery systems were being recharged by the solar panels.

The central stabiliser battery (in red) is continually charging and discharging to maintain the quality of the electricity when the houses are in island mode.