



Ballarat General Cemeteries Solar Project

The Ballarat General Cemeteries is a not for profit organisation run by a trust appointed by the Victorian Governor. It manages the Old Ballarat Cemetery established in 1856, the New Ballarat Cemetery and the Ballarat Crematorium. The Ballarat Cemeteries Trust approached the Ballarat Community Power Hub in 2017 to gain assistance in the investigation of solar electricity as a source of energy for its operations. In 2018, CPH Ballarat engaged RENEW (Alternative Technology Association) to investigate the electricity meter data for the BGC's five electrical supplies and to model the impacts of photo voltaic (PV) installations of various sizes on each of the supply circuits.

While the RENEW report identified the benefits of rooftop and or ground mounted PV installations, the analysis of historical electricity and gas consumption revealed several issues that needed investigation before a solid business case could be undertaken:

- Much of the electrical consumption was attributed to the irrigation systems used seasonally for garden and lawn maintenance, fountains and decorative water features.
- The irrigation system efficiency could be significantly improved through investment in new pumping infrastructure utilising variable speed electric motors and system repair and refurbishment.
- Investigation of battery powered electric small and medium grounds maintenance plant to replace petrol and diesel equipment, could be beneficial if sourcing energy from PV installations.
- The natural gas-powered cremator unit could be investigated to see if heat could be captured and re-used within the BGC operations.
- The five metered electrical supplies resulted in considerable fixed electricity supply charges, therefore a cost benefit analysis of consolidating electrical supplies needed to be undertaken.

Community Power Hub Ballarat provided a report to the BGC Trust in August 2018 identifying these findings and issues which resulted in BGC:

- Investing in battery driven small plant (hedge clippers, brush cutters, blowers etc.)
- Investing in a variable speed irrigation pumping system.

Community Power Hub Ballarat also funded a feasibility study into heat recovery from the cremator which was undertaken by Invertech Technical Engineering Services which determined:

- That the waste heat was not easily able to be used elsewhere in the BGC's operations;
- that conversion of the waste heat to electricity was not considered viable at this stage, while a prototype generator was being developed and trialled at Geelong Crematorium; and
- that given BGC require a second cremator, the new gas unit will be much more efficient.

In 2019, the BGC advised the organisation was still keen to consider rationalising their power connections and installing PV arrays. CPH Ballarat convened a project working group with the BGC Operations Manager, Consultant Scott White from Environmental Evolution and two representatives of CPH Ballarat Project Control Group. The costs of rationalising electricity feeds and meters were identified, with the group considering PV locations including roof mounted, ground mounted and

floating on the large irrigation dam. Feedback from the BGC Trust indicated willingness to seek a power purchasing agreement (PPA) that would include the supply of meter rationalisation headworks and supply roof and ground mounted PV installations.

Environmental Evolution obtained meter data for the preceding 12-month period and produced the following summary which was used to present to the Trust in May 2020.

Summary

- ▶ Solar Power Purchase Agreement (PPA) proposals
 - ▶ Current requirements
 - ▶ Office and Cremator
 - ▶ Future proofed and large visual statement
 - ▶ Preferred roof and ground PV array locations
 - ▶ Workshop and dam pump
 - ▶ Crematorium roof shading






Savings Summary – 30kW roof mount for the office and cremator

	System size (kW)	Annual output (kWh)	CO2 Savings P.A (Tonnes CO2)	Annual savings (\$)
Office / Cremator - current requirements	30	40,922	44.20	\$2,792.38

NOTES: Positive payback from year 1
 Pricing based on a 20 year Power Purchase Agreement
 No investment required by the cemetery
 \$0 Balloon payment at end of term
 25 Year Panel Warranty period
 Insulates the site from future energy price shocks






Savings Summary – Northern end future proofed 99kW roof and ground mount array

	System size (kW)	Annual output (kWh)	CO2 Savings P.A (Tonnes CO2)	Annual savings (\$)
Office / Cremator – Nth end future proofed scenario	99	135,043	145.85	\$5,467.00

NOTES: Positive payback from year 1
 Pricing based on a 20 year Power Purchase Agreement
 No investment required by the cemetery
 \$0 Balloon payment at end of term
 25 Year Panel Warranty period
 Insulates the site from future energy price shocks



Savings Summary – Future proofed 99kW roof and ground mount array, plus Workshop and Dam Pump array

	System size (kW)	Annual output (kWh)	CO2 Savings P.A (Tonnes CO2)	Annual savings (\$)
Office / Cremator + workshop and dam pump – total site future proofed scenario	129	175,965	190.04	\$3,691.43

NOTES: Currently electricity is supplied to the workshop and pump shed via separate meters. Due to the high cost of capital required to combine the meters, as a standalone system the solar PPA rate for the workshop and dam pump exceeds the current cost of electricity, but remains viable from a whole of site perspective.

Positive payback from year 1, no investment required by the cemetery
 \$0 Balloon payment at end of term
 Insulates the site from future energy price shocks



Roof and ground mount PV array locations



- Office and Crematorium
 - 30kW on office, shed, and shed extension
 - Future proofed 99kW system. 61kW on roof / 38kW ground mount system. This requires 200m², which is approximately 10% of the available grounds on the Doveton St / Swinglers Rd corner

NOTES: Images for visual interpretations only.
Ground mount system requires Heritage Permit from the City of Ballarat



In May 2020, the BGC Trust accepted the recommendation for a PPA with a 20 year term to supply a 99kW PV system to the Northern sector of the cemetery, plus a 30kW PV system to the southern sector incorporating works to rationalise the electricity connections and meters.

The project team also considered emergency independent electricity supply options for the cremators and administration as the cremation of bodies has been identified as an essential service by the Victorian Government and as such requires a business continuity plan that includes disruption to grid power supplies. The CPH Ballarat was able to present a range of options including lithium ion batteries, on site and hired generators with investment costs, maintenance costs and considerations.

In June 2020, the Victorian Government announced funding for a suitable battery and associated control systems to operate the Crematorium and Administration operations on the condition it be powered by on site solar generation.

In summary this CPH Ballarat project has highlighted a process applicable to similar institutions and large scale public open space asset managers which involved:

- Assessing historic electricity, gas and water use and associated costs.
- Investigating energy efficiency measures to reduce consumption and fixed charges.
- Investigating renewable energy opportunities for operation of stationary and mobile plant and equipment.
- Investigating opportunities for PV and battery installations to reduce grid demand for electricity.
- Investigating cost benefits including payback period and levelised cost of energy for various sized systems and methods of financing.