

CASE STUDY: Off-grid with solar and wind on dairy farm

Summary

Application	Off-grid
Location	Gippsland, Victoria
System Objective	Run a dairy farm with two daily milking cycles completely off-grid
Commissioned	March, 2016
Installed PV	60 kW
Useable battery storage	120 kWh
Designed & commissioned by	Jason Svarc, Clean Energy Reviews



Background

This off-grid system was originally designed to work as a grid-connected energy storage system. At the time of installation a new mobile (NBN) tower was being installed on the same property that required a power connection. The existing 35+ year old grid supply to the farm was undersized and showing signs of thermal damage due to overheating. The new grid supply was to be based on the existing supply (63A) and was also undersized especially with the additional distance to the dairy. Due to the delays with the mobile tower, power meters and risks involved, it was decided to run the system completely independently of the grid for the summer period and monitor it as winter approached.

Challenges

Dairy farms require a large amount of energy to operate due to the high power consumption of the vacuum pumps, compressors and milk vat refrigeration systems, as well as irrigation in summer. To add to the difficulties, over a third of the energy used is early morning well before the sun is up. With this in mind, powering a dairy farm using a solar off-grid battery system posed many challenges.

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Being located in SE Victoria, in a temperate climate, there was concern that the system would not generate enough energy during the short winter days. However, with some careful monitoring and slight adjustments to milking, the farmer was able to power the dairy through the darkest winter days and only had to use the old (now back-up) supply for 8-10 morning milking cycles.

Solution

Due to the high power demand of the milking equipment, three Australian made Selectronic SP PRO inverters were chosen to power the dairy. These powerful 20kW multi-mode battery inverters also function as the energy management system, with nine ABB solar inverters controlled by the SP PROs.

The 240 solar panels (60kW) are designed to do the bulk of the work while the three 1kW vertical axis wind turbines assist with the battery charging. The solar is performing far beyond expectations with the afternoon milking cycle being directly powered by the 22.5kW west facing and 28kW of north facing solar panels. There are also 9.5kW of east facing panels to help capture the morning sun. The early morning milking is powered completely from the energy stored in the large 240kWh Gel VRLA battery bank, which has enough reserve energy for 2-3 days of bad weather. The batteries are generally recharged by early afternoon before the second milking cycle.

Outcomes and Benefits

Overall the farm was powered by the system for approximately 99% of the year, saving the owner around \$2100-2600 per month or about \$30,000 in annual electricity costs.

The installation was financed through a small business loan and the energy savings cover the loan repayments with an estimated payback of around six years, accounting for the expected increase in power prices. The solar panels are warranted for 10 years but most quality panels perform well for 25-35 years. The SP PRO inverters have a 10 year warranty but with their track record are expected to function for 20+ years. The batteries however, due to the high power demand, are not expected to last more than 10 years. Although with the rapidly advancing lithium batteries and huge price reductions, the cost of replacing the batteries in the future should be minimal in regard to the overall savings made.

System Components

Multi-mode inverter	Selectronic	3 x SP PRO SPLC 1202, 20 kW, 120 V
Grid-tie inverter	ABB	9 x PVI-6000, 6kW
PV Array	Hanwha	240 x QCells 250w
Wind turbines	Lumenaus	3 x vertical axis wind turbines
Batteries	Lumenaus	60 x GEL VRLA 2000 Ah, 2V

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