



CASE STUDY

ENERGY SAVINGS IN XANADU'S WINERY



ENERGY USE IN THE WINERY

There is an increasing urgency around us to act on climate change, and as an industry which is reliant on the weather and climate, we have a vested interest in doing everything we can to reduce our carbon footprint and reduce the emissions that cause climate change. It is projected that Margaret River's mean growing season temperature will rise from 18.9°C in 1997-2017 to 22.1°C in the period 2081 – 2100, and we are looking at a 36% increase in incidents of heatwaves by 2060 (Remenyi et al, 2019). Looking at these projections Margaret River's 2065 growing season will more closely resemble that of current day Swan Valley if we continue down this path.

Pressure is also coming from customers, and producers need to align with the global demands to reduce emissions to ensure we have long-term market access. Without this we are looking at exclusion from international markets and a loss of credibility putting the long-term sustainability of Australian wine at risk (Wine Australia Emissions Reduction Roadmap, 2023).

Carbon emissions from winemaking make up 13% of the carbon footprint of wine, with 72% of that coming from electricity use (Hirlam et al, 2023), encouragingly this is a reduction from previous numbers that showed 17% of the carbon footprint of wine coming from the winery, with 82% of that coming from electricity use (Smart et al, 2020).

With electricity consumption making up such a high percentage of the winery's carbon footprint this is an ideal place to be able to make a significant cut to emissions, and the winery budget's bottom line.

There are a number of ways a winery can reduce power usage in day-to-day operations with minimal capital outlay such as reducing water use through more efficient cleaning and wash down practices, increasing chiller brine temperatures when operations allow, and ensuring all equipment is well maintained and operating efficiently. Mid-range capital expenditure such as replacing older lighting with LEDs can have a larger impact and can pay for themselves in under 2 years. Big ticket items such as solar panels will be where wineries can expect to see the largest savings but will also need the largest outlay.







WINERY PROFILE

Established in 1977 by Dr John Lagan, and purchase by the current owners, the Rathbone family, in 2005, Xanadu is one of Margaret River's most awarded producers. Between their 3 vineyard sites they have 88 hectares under vine, and along with purchased fruit and some contract processing, this sees the winery process between 1100 and 1400 tonnes per year.

Xanadu was an early adopter of the Sustainable Winegrowing Australia program having been a certified member since 2011, and they were the first in the region to use the trust mark on their labels. They take an active approach to sustainability within their business and have a number of sustainable initiatives to reduce emissions & waste, and increase soil health & biodiversity. Xanadu's efforts in caring for the land extend beyond their own front gate to conservation efforts focussing on the Boojidup Water Catchment area, Margaret River mouth and areas of the Cape to Cape track.



PROJECT OVERVIEW

In order to reduce their carbon footprint, and overall bottom line, Xanadu embarked on a project to reduce energy usage and electricity consumption from the grid. Here we focus on a number of the practices and upgrades they put into place to achieve this goal.

Over the last 10 years Xanadu have:

- upgraded lighting to more energy efficient LED lighting
- made use of floatation technology to clarify juice for aromatic white varieties
- upgraded their refrigeration system
- · installed solar panels for energy production



LED lighting

Although lighting generally only accounts for 5% of total energy used in the winery (Szentpeteri, 2018), the switch to LED lighting can typically show a payback over two to four years dependent on winery operations, so it is a worthwhile investment.

There are numerous advantages to LED lighting over the traditionally used metal halide high bays. LED last longer than any other commercially available light source with a 40 000 -60 000 hour (around 30 year) lifespan being typical, compared to 9000 hours (5.5 years) for metal-halide (MH) lights. LED emits less heat than traditional lighting options, so is not competing with the cooling system in the cellar or barrel hall. Over the past 4 years Xanadu have been replacing their lighting with more efficient LED lighting. Initial projections showed energy savings of 66% compared to existing lighting, or a total of 12,893 kWh over 12 months, and a payback period of 1.2 years.

Lees flotation

Flotation for juice clarification works by employing gas (most commonly nitrogen), along with the use if flocculation aids, to disperse solids from the liquid, followed by reverse racking the clean juice from under the floated solids. Using lees flotation can use up to 90% less refrigeration energy than cold settling lees (Winery Energy Saver Toolkit, 2014).

Floatation for clarification can have a multifaceted impact on energy consumption in the winery. As flotation is most efficient at 14 – 16°C, grapes will often not require must chilling and, as juice can be floated, racked and inoculated in the same day it is pressed, the juice may not require chilling until fermentation has commenced. Using floatation not only reduces the overall energy requirements, but also the peak energy load during vintage. Indirectly it reduced the energy consumption during the subsequent cleaning of the tank as there will be less tartrates deposited in the tank.

Floatation does have its limits and, in particular it does not allow for great control of turbidity, and as such Xanadu still cold settle for Chardonnay, however they do use flotation for all aromatic whites, and have been doing so for 10 years.



Project Cost - ex GST	\$5,310
Payback period	1 year/s 2 months
Net savings - 5 years	\$18,136 (total 5 year savings minus project cost)

Figure 2. LED lighting payback data as supplied by Fusion Electrical



Figure 3. Juice lees during flotation with solids rising to the top. Picture courtesy of Della Toffola Pacific.

Year 5

Payback Graph

Refrigeration

By far the highest use of electricity in most wineries is refrigeration and air conditioning, with it generally accounting for 50 - 70% of total site energy consumption (Smart et al, 2020), and this is an area where we can save up to 20% of energy consumption in the winery (Nordestgaard et al, 2012).

Refrigeration is critical to many winery operations, at Xanadu this includes the following:

- Must chilling
- Juice clarification for Chardonnay
- Fermentation control
- Cold stabilisation
- Wine storage

Prior to vintage 2021 Xanadu upgraded their chiller unit, primarily to increase capacity, but by modernising they have acquired a more energy efficient unit. The new unit is a packaged chiller, Trane CGAM air cooled chiller, this chills brine in a storage tank that is then pumped to the winery as required. The installation of an energy efficient chiller can see an energy saving of 10–50% of chiller energy consumption (Winery Energy Saver Toolkit, 2014). The new unit employs Smart controls allow the system to take advantage of peak and off-peak energy where by the system cools the brine to -7°C during off peak periods, and -5°C during peak periods, for every 1°C increase in temperature setting refrigeration energy use will drop by 2-4% (Winery Energy Saver Toolkit, 2014), so even a small change can make a significant difference here.

Regular service and maintenance is imperative to an energy efficient refrigeration unit, Xanadu have a close working relationship with their refrigeration technician and ensure the system is well maintained.



Figure 4. Typical winery energy usage. Szentpeteri, 2018



Figure 5. Old vs new. Xanadu's old refrigeration unit (A), and upgraded Trane unit (B).

Solar panels

There is always going to be a limit to reducing energy consumption in the winery as wine production is an energy intensive process, so the next step to reduce energy costs and the carbon footprint of wine production is installation of renewable energy sources. Currently solar is the most accessible option and it makes sense given Margaret River's abundant sunshine, the available surface area on and around wineries, and, for most small to medium sized wineries, the bulk of electricity demand being during daylight hours. Power consumption at Xanadu is typical of Margaret River wine producers with peak demand in March and April when vintage is in full swing, this allows them to take advantage of the still relatively high solar generation at that time of the year, as shown below.

When it comes to solar panel installation for wineries it is important that a number of factors are examined to find the right system for the job. The team at Fusion Electrical looked at Xanadu's energy consumption patterns on a day-to-day basis as well as across the whole year, this showed an average daily consumption of 1,752kWh. Looking at the aspect and tilt of the solar panels along with local weather and solar data it was determined a 99.7kW system would generate 424kWh/ day, making Xanadu 24% self-sufficient. There are times when solar generation is higher than consumption and this energy is returned to the grid.

Based on advice received, in 2021 Xanadu installed a 99.7 kW solar system with the aim to generate some of their own power, thus reducing their reliance on the grid and cutting overall electricity costs and carbon emissions.

Initial calculations show that Xanadu's break even point for the installation of the solar panels would be around year 5 to 6, with the return on investment over a 25 year period of over \$1 million dollars. As the system Xanadu installed was under 100kW they were eligible for small-scale technology certificates (STCs) which can then be sold to offset the cost of the system.













OUTCOMES

Since Xanadu has introduced energy saving efforts such as LED lighting, more efficient refrigeration system and solar panels they have seen a drop of up to 19.5% of energy consumed from the power grid when we look at comparable years in terms of tonnes processed, or in whole numbers approximately 90,000kWh per year which is roughly equivalent to 64 tonnes of carbon dioxide emissions per year. They are now showing up to 26% self sufficiency, and in the first year of having solar saw a reduction in their power bill of over 30%. If all wineries in Margaret River went down this path we would be looking at a combined regional savings of 2000 tonnes of carbon emissions per year.



Power grid energy consumption kWh/ tonne



Energy per tonne consumed from the power grid. Data supplied by Synergy.

RESOURCES

For more information on STCs for solar panels or other renewable energy systems visit the CO2 Clean Energy Regulator website. The South Australian Wine Industry Association's Winery Energy Saver Toolkit has a wealth of information for wineries large & small to save energy. It can be downloaded from here along with supporting documents: www.winesa.asn.au/news-resources/ environment-sustainability/winery-energy-saver-toolkit

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