AWRI

opportunities in a new climate

Case study

WINEMAKING

Winery refrigeration: opportunities to save electricity

Electricity consumption is the largest contribution of greenhouse gas (GHG) emissions from many Australian wineries (Figure 1). Refrigeration is a critical component of quality Australian wine production and accounts for as much as 50 to 70% of winery electricity consumption. This fact sheet provides information to help wineries decrease electricity use and associated GHG emissions from the use of refrigeration.

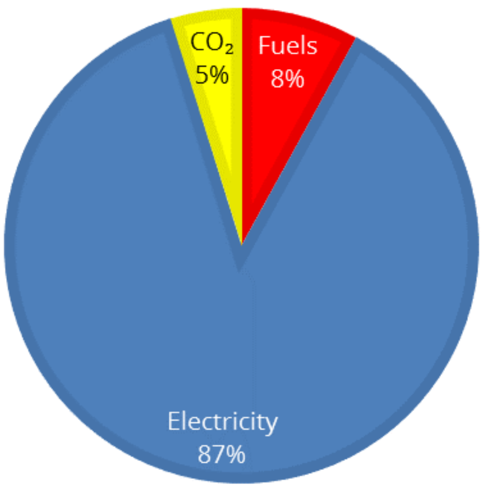

Figure 1. Sources of greenhouse gas emissions from Entwine Australia member wineries in 2014/15

Brine temperature

To minimise electricity use, brine temperatures should be set at as warm as practicable and the warm temperatures should be maintained for as much of the year as possible. Operations requiring very low brine temperatures, such as cold stabilisation, should be scheduled to occur on all wines during a set period of each year instead of intermittently. This will allow the period when brine temperature is kept low to be minimised. Maintaining warm brine temperatures for as much of the year as possible reduces energy consumption.

Alternative practices

Technologies that avoid the need for very cold brines should also be considered. Cold stabilisation is one method for precipitating tartrate crystals from juice and wine, but there are other options that reduce the need for cooling. Crystallisation inhibitors (e.g. carboxymethylcellulose, mannoproteins), electrodialysis or packaged rapid contact systems are alternative options available for cold stabilisation. Flotation systems can also be used for juice clarification as an alternative to cold settling.

Other strategies to reduce energy use

Prevent condensation: When water condenses and freezes on brine distribution pipes and tank jackets (Figure 2), considerable heat is transferred to the brine. Insulation can prevent this process and save energy. Insulation of the refrigeration plant as well as the brine reticulation system and wine tanks saves energy use and greenhouse gas emissions.

Figure 2. Ice forming on a short section of the system that is not insulated

Recover useful energy: Product heat exchange is a means of recovering useful energy and involves using, for instance, chilled wine that no longer needs to be kept at low temperature to assist in pre-cooling wine destined to be chilled. This strategy may require increased planning to coordinate the movement of wine.

Avoid tank stratification: Wine temperature is important for quality but can vary considerably within the tank when cooling unless the tank is being agitated or the wine is actively fermenting. An incorrect temperature reading can result in excessive and unnecessary cooling at the expense of energy efficiency and wine quality. To ensure a correct temperature assessment, take readings from different locations in the tank or agitate the tank prior to taking the measurement.

Plant shut-down: During periods when there is no need for refrigeration, running systems in 'energy saving' mode can save considerable amounts of energy. A winery investigation showed that when the refrigeration system was 'turned down' for a four-month period of the year when cooling was not required, electricity consumption decreased by approximately 24% compared to the previous year.

Case study

A case study was performed in a medium-sized (~500 tonnes) South Australian winery to assess the impacts of increasing the temperature of brine for cooling red wine ferments. The temperature of the brine was increased from -5°C to +4°C for a period of one year. Despite the additional time taken for the ferment to cool, a 17% decrease in refrigeration-related electricity consumption was achieved which resulted in a saving of more than $5,000 and 16 tonnes of CO_2-e (Table 1). No negative impacts on wine quality were seen from implementing this change.

Table 1. Effect of increased brine temperature on electricity consumption and expenditure

	Brine temperature	
	-5°C	+4°C
Electricity ('000 kWh)	150	124.5
Cost ($ @ $0.20/kWh)	30,000	24,900
Greenhouse gas emissions* (T CO_2-e)	96	80

* Australian Wine Carbon Calculator

The increased efficiency of electricity use achieved by increasing brine temperature at this winery resulted in an improved ranking from being in the lowest 51% of member wineries for electricity use to being in the lowest 39% compared to other similar-sized Entwine member wineries (Figure 3).

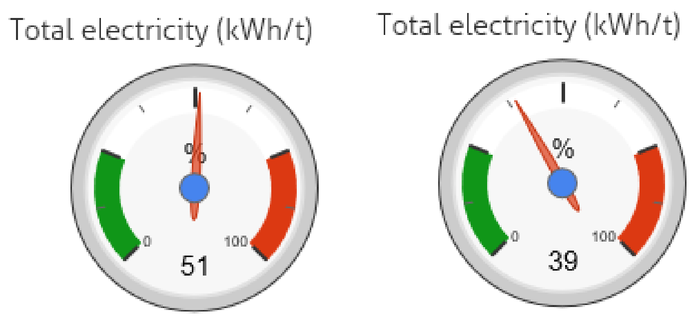

Figure 3. Increased brine temperature improved the winery's ranking of electricity use compared to other similar-sized Entwine member wineries. Winery ranking before (left dial) and after (right dial) the practice change.

Acknowledgement

This fact sheet draws on information from a Wine Australia-funded project on refrigeration carried out by AWRI Commercial Services. The AWRI's Extension and Outreach project was supported by funding from the Australian government. The AWRI is a member of the Wine Innovation Cluster in Adelaide.

References and further reading

Improving refrigeration and heat transfer

Improving winery refrigeration efficiency

Improving winery refrigeration efficiency Winery A case study report

Improving winery refrigeration efficiency Winery B case study report 1

Improving winery refrigeration efficiency Winery B case study report 2

Contact

For further information, please contact AWRI helpdesk:

Phone 08 8313 6600 **Fax** 08 8313 6601 **Email** helpdesk@awri.com.au

Website http://www.awri.com.au/industry_support/new_climate/

Address Wine Innovation Central Building, Corner of Hartley Grove & Paratoo Rd, Urrbrae (Adelaide), SA 5064