Green Industries South Australia

Winery Resource Efficiency Benchmark Report

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Introduction to winery resource efficiency benchmarking

Resource efficiency benchmarking provides the ability to examine and understand resource efficiency performance in relation to others. This report can be used to compare resource efficiency performance against peer wineries, and can also be used as a guide on what to measure to determine resource efficiency metrics relevant to your winery. Comparing resource efficiency performance with peer wineries allows you to understand where process efficiencies may be different and can thereby help to identify areas of focus to increase efficiencies and reduce operating costs.

This report provides average resource efficiency performance benchmarks for the South Australian wine industry based on the performance of 32 wineries across South Australia during the 2014 and 2015 vintages.

Data sources

Data for this report has been collected from a variety of sources including:

- accounting reports
- energy and material audits
- lean production for wineries programs
- activity based costing projects

The report provides resource efficiency benchmarking based on resource usage and associated costs for labour, electricity, fuel, water, materials and waste in relation to the volume of wine produced.

Rationalising units

Choosing the right units for rationalising resource performance is essential for providing useful resource efficiency information.

Resource efficiency for winery measurements should not be based on the quantity or cost of resources alone. Variations in volume and quality of wine produced from year to year typically change the quantity and overall cost of resources consumed.

Rationalising resource quantity and cost against the ‘volume of wine produced’ provides a method to measure resource efficiency performance and is the unit used throughout this report.

This comparison can be used by a winery to measure performance across its years of operation, and can also be used to compare against industry average performance with wineries of a similar size.

Winery variation and the impact on resource performance

Wineries in South Australia operate under a range of different business models. Naturally, this can have a large impact on resource efficiency. For example, wineries that sell bulk wine have a

lower operating cost (particularly labour and materials costs) than wineries that undertake barrelling and packaging on site. A list of business model variations has been included below:

- Crushing grapes for juice
- Receiving bulk juice
- Receiving finished wine
- Producing bulk wine
- Producing bottled finished wine
- Producing cask finished wine
- Bottling on-site vs. bottling off-site
- On-site storage vs. off-site storage
- Contract wine making
- A combination of the models listed

Where possible, data for this resource efficiency benchmarking report has been sourced from winery operations only, i.e. excluding packaging, administration, hospitality services and grounds keeping. In cases where winery activities were not able to be separated from ancillary services (approximately 30% of wineries in the benchmarking project) their data has been removed from the data set, as have any outliers greater than two standard deviations from the mean.

Economies of scale

Resource efficiency performance is largely dependent on the size of the winery. Larger wineries (those that produced larger volumes of wine) are typically more resource efficient than smaller wineries due to economies of scale, and this is reflected in the performance benchmarks.

However, there can be a high degree of variation in resource efficiency between wineries of a similar size. This difference is due to process efficiencies i.e. some winemaking practices require fewer inputs than others, yet the volume of wine produced is the same. For some, this means that reviewing and changing processes (winemaking practices) can have a significant impact on resource efficiency and operational costs.

Limitations of available data

Obtaining the right resource use and cost data is an essential step in understanding resource efficiency performance. Most wineries have excellent data for labour, electricity, fuel and water as the cost and quantity of these resources are well known and tracked by wineries (or can be obtained from invoices and accounting information). Data is less reliable for waste and material resources as it needs to be classified into various subtypes to provide meaningful benchmarking information. For example, many wineries do not classify or quantify waste leaving the winery and instead pay a set fee for waste disposal. Therefore, it is challenging to understand the tonnage of recycled and landfill waste leaving the winery.

Materials need to be segregated into primary materials used in the winemaking process to effectively measure efficiency. These materials may include:

- Carbon Dioxide (gas and dry ice)
- Acids (tartaric and citric)
- Bases (KOH, NaOH)
- Cleaning chemicals
- Refrigerants
- Filtration medium

A representative sample size for materials efficiency data was unavailable and therefore material benchmarking has been omitted from this report.

Wineries use a variety of methods to dispose of waste water. In some cases, wineries will re-use waste water to irrigate vineyards, treat and dispose of waste water through trade waste, re-use water on site for cleaning, etc. This variation in waste water treatment methods (and lack of reliable data to measure volumes of waste water) has meant that waste water treatment and costs have been omitted from this report. Naturally, wineries that re-use waste water for cleaning or irrigation have much lower waste water treatment costs than those wineries that treat and dispose of waste water through trade waste methods.

The amount of information available from each winery in the dataset varied and hence not all resource efficiency metrics are based on the full dataset.

The number of wineries used in the analysis for each metric is reported above the corresponding graph.

Resource efficiency benchmarks

The following section provides graphical representations of winery resource efficiency metrics which can be used for benchmarking purposes.

The blue 'trend line' represents the mean (average) for the sample wineries' resource use and costs. Each blue 'trend line' includes the coefficient of determination equation contained in each graph.

The red dashed line in each graph represents one standard deviation from the mean and illustrates the degree of variance of the data set (noting that outliers greater than two standard deviations were removed from the dataset).

The graphs are based on a logarithmic wine production scale to account for the considerable variability in winery sizes.

How to use the graphs

To compare your winery's resource efficiency against the benchmark data, you will need to calculate your efficiency metrics for each resource. To do this you need the total volume of wine produced in a given year in kilolitres (kL), and values for the quantity and cost of each resource you want to compare for the same period (noting you will need to use the same units as those shown in the graphs to make a direct comparison). Then you divide the resource amount by the volume of wine to give you an efficiency metric.

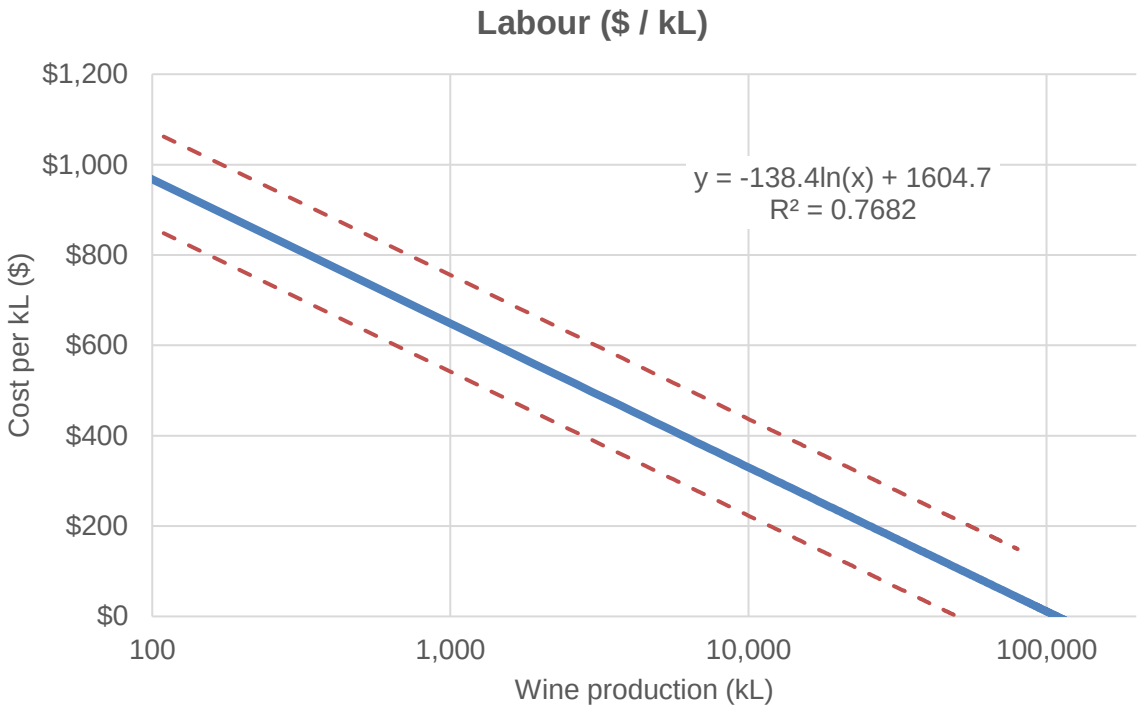
For example, electricity efficiency can be calculated by adding up all electricity used in a 12-month period (e.g. 400,000kWh) and divide by the quantity of wine produced in the same 12-month period (e.g. 1,000kL). This calculation would result in a resource efficiency value of 400kWh per kL of wine produced.

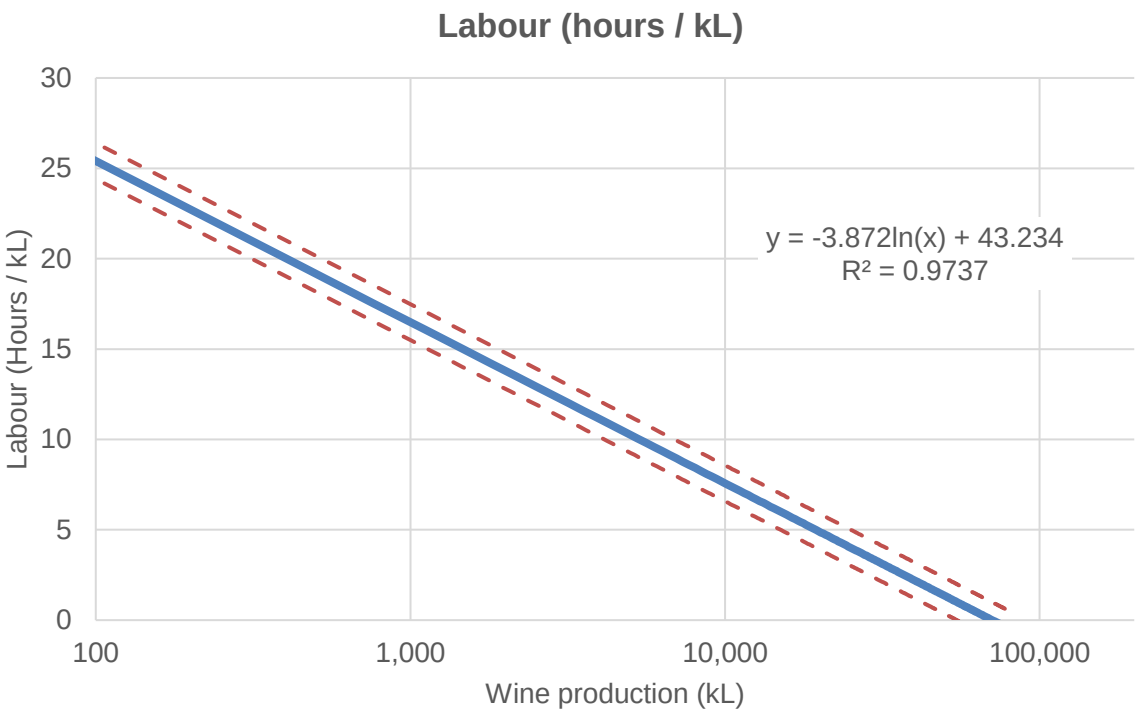
Using the electricity kWh / kL graph (page 9), the resource efficiency value can be compared against the benchmark data. For a winery with a production of volume 1000kL, the average electricity use is approximately 350kWh per kL. The value of 400kWh per kL is slightly higher than the average and so the winery may wish to review electricity use and consider projects to increase electricity efficiency.

Labour

- Labour cost per kL of wine – based on **11** wineries.
- Labour hours per kL of wine – based on **5** wineries.

Labour use varies considerably between wineries of a similar size. In some cases, wineries could not separate winery labour cost with administration, management, hospitality labour and executive salaries. Where practical, these outliers have been removed from the dataset.



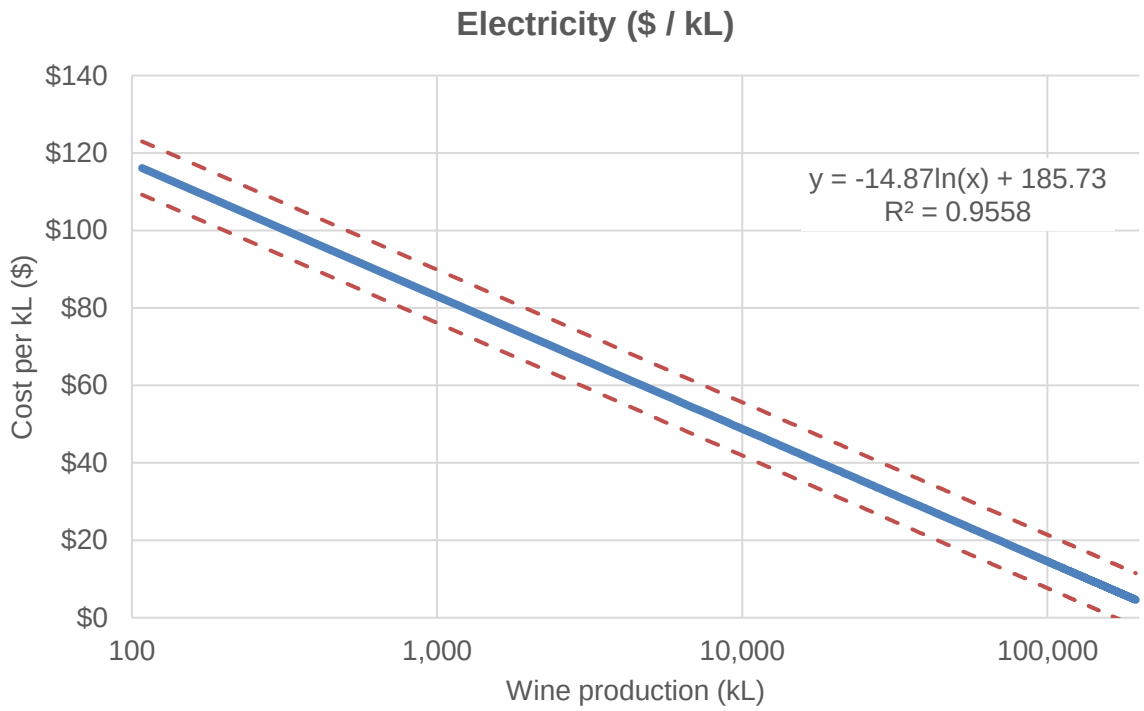

Labour (hours / kL)
30
25
20
15
10
5
0
Labour (Hours / kL)
y = -3.872ln(x) + 43.234
R² = 0.9737
100
1,000
10,000
100,000
Wine production (kL)

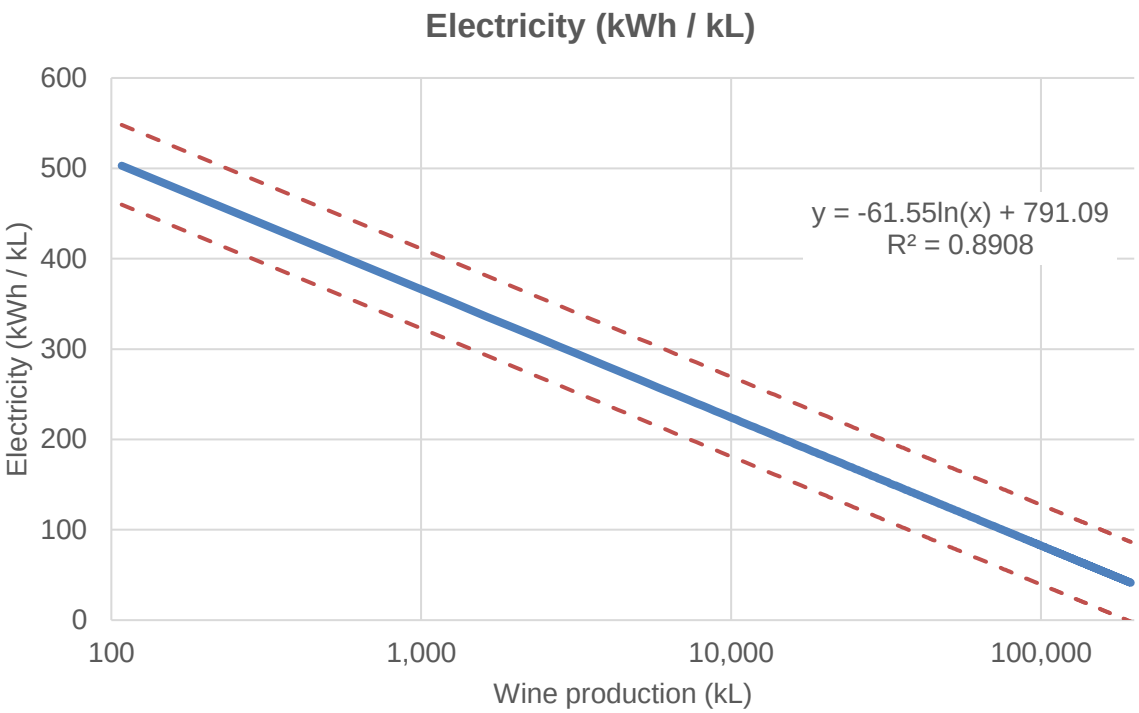
Electricity

- Electricity cost per kL of wine – based on **17** wineries.
- Electricity use (kWh) per kL of wine – based on **18** wineries.

If you are considering increasing efficiency in relation to electricity, note that refrigeration systems typically consume the largest quantities of electricity for a winery. Refrigeration systems that have been optimised and automatically controlled tend to consume less electricity per kL of wine produced than other wineries, hence optimising your refrigeration systems may help to improve performance in this area.

The graphs below include purchased electricity and associated costs (i.e. usage and network costs). Some wineries have supplemented purchased electricity with solar power production, and this has lowered their purchased electricity costs per kL of wine produced, however, this has involved significant investment cost. Two wineries from the trial group used solar to supplement their electricity use. Data from these wineries exceed the 'normal' data values of the dataset and were omitted from the results.




Electricity (kWh / kL)
600
500
400
300
200
100
0
Electricity (kWh / kL)
y = -61.55ln(x) + 791.09
R² = 0.8908
100
1,000
10,000
100,000
Wine production (kL)

Water

- Water cost per kL of wine – based on **11** wineries.
- Water use (kL) per kL of wine – based on **15** wineries.

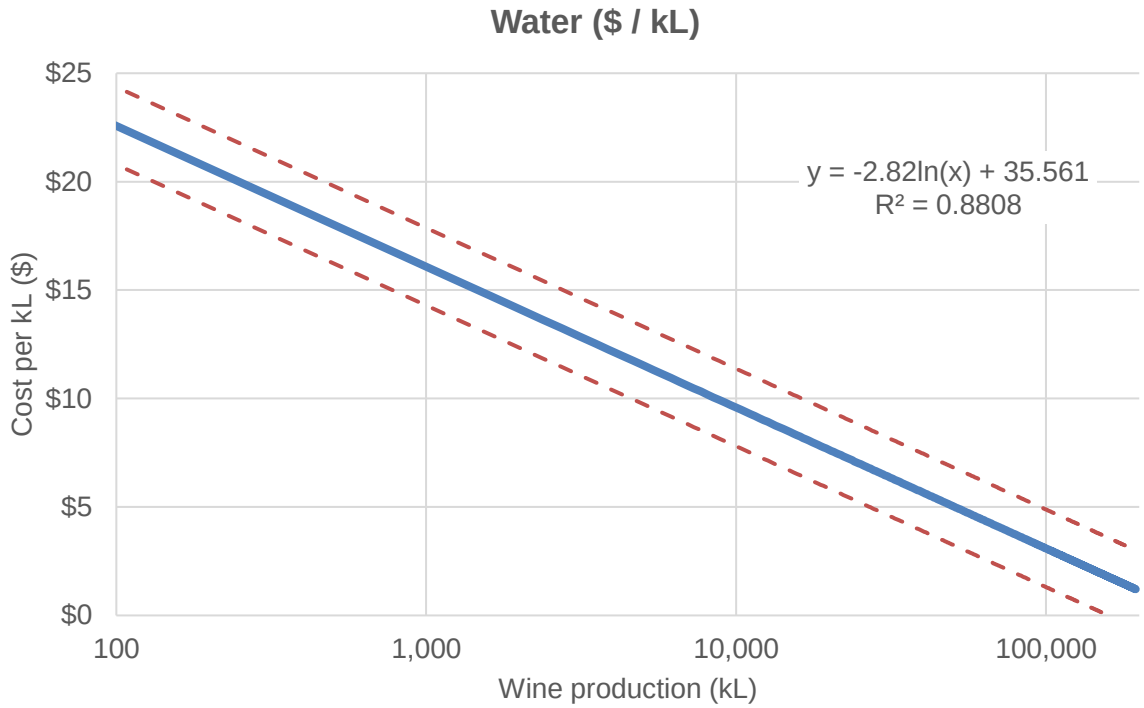
Most wineries consumed between 1kL and 4kL of water per kL of wine produced.

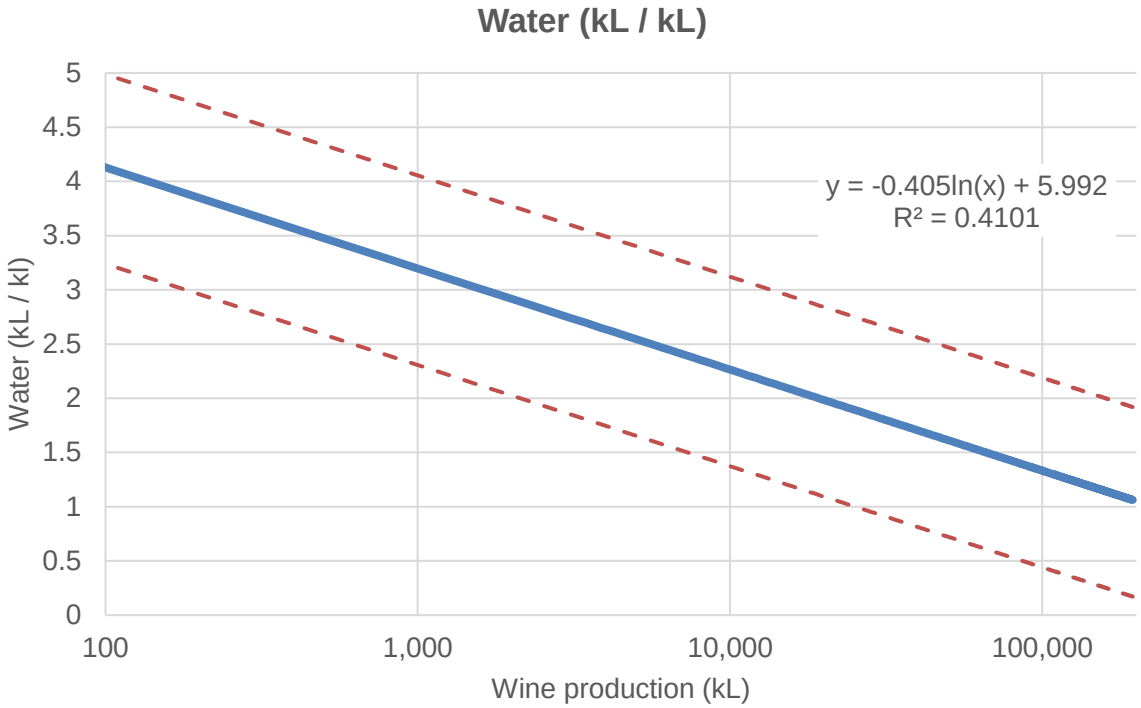
When reviewing the graphs below, note that wineries can have different sources of water, and this can have a significant impact on the cost of water per kL of wine produced. These sources of water may include:

- Mains water
- Bore water
- Rainwater
- Trucked water
- Dam / river water
- A combination of water sources

Wineries using rainwater, dam or river water naturally have a low water cost per kL of wine. Wineries with bores tend to pay a licence fee, and this is factored into the water cost per kL of wine shown below. Wineries not connected to mains water require water to be trucked in and pay the highest water costs (typically 10x the cost of mains water). Wineries with excessively high or low water costs have been removed from the benchmarking dataset so the information presented below should be considered an average of the remaining wineries.

Water is used for several primary purposes. If you are considering increasing performance in relation to water use efficiency, note the two largest water use activities are 'pushing' wine and cleaning. Wineries that minimise wine movements between tanks or use 'pigging' tend to have a lower water consumption than other wineries.





Fuel

- Fuel cost per kL of wine – based on **15** wineries.
- Fuel use (MJ) per kL of wine – based on **14** wineries.

Several different fuels are used within wineries including:

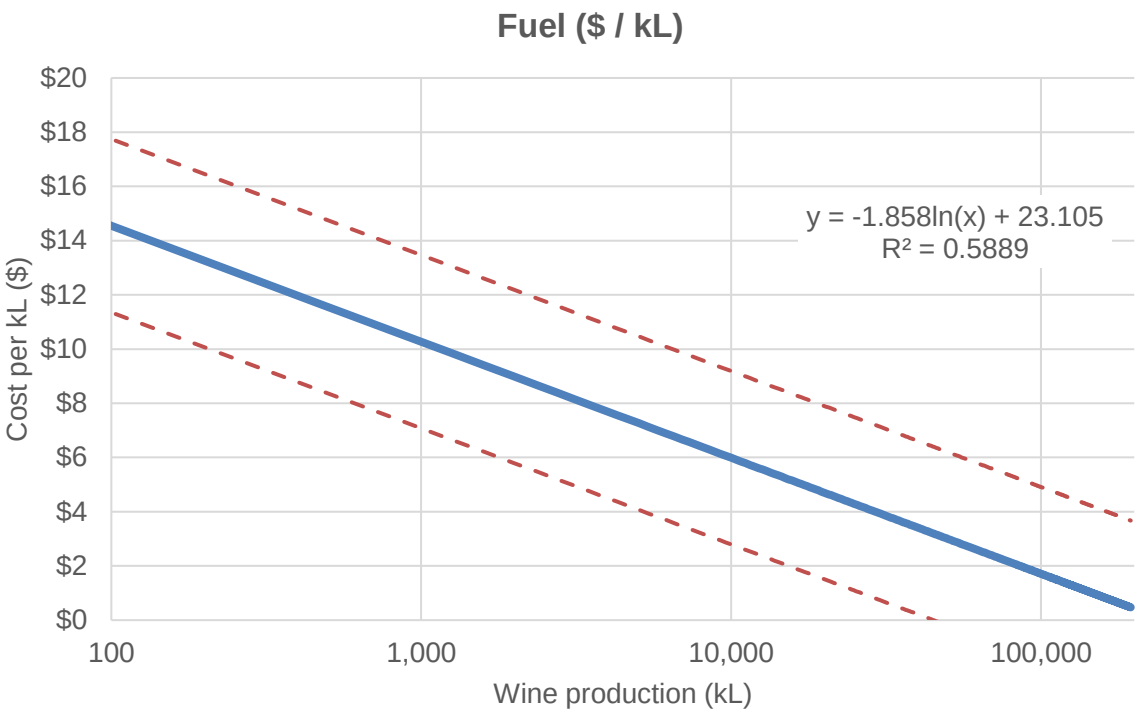
- Natural Gas
- LPG
- Petrol
- Diesel

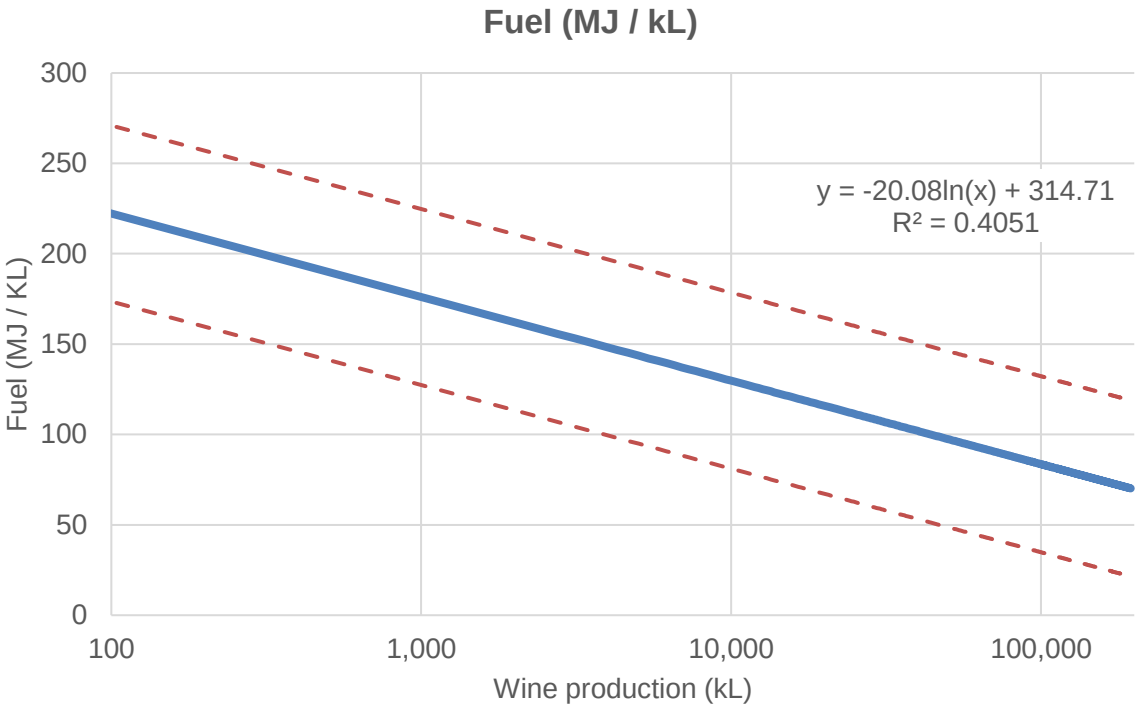
Each of these fuel types has various uses within the winery (sometimes multiple applications). For example, LPG may be used for onsite boilers or forklifts. Diesel may be used for onsite vehicles, generators or in some cases, boilers.

Each fuel source has a different cost per MJ of energy, and this creates some variation between cost per kL of wine (in particular the cost of LPG vs. Natural Gas for boilers). Wineries that rely on diesel generators to supplement electricity during vintage have a higher fuel cost per kL of wine than wineries that don't use diesel generators, hence, wineries that use generators are likely to sit closer to the top red line than those without generators.

The primary use of fuel on site is heating water for cleaning or for warming wines during vintage. Reducing these activities may improve fuel use efficiency performance.

Each fuel used in a winery needs to be converted into MJ to compare against the resource efficiency benchmark graph below. The easiest way to do this is to use an online energy conversion calculator to convert your fuel into MJ of energy.


Fuel ($ / kL)
$20
$18
$16
$14
$12
$10
$8
$6
$4
$2
$0
Cost per kL ($)
y = -1.858ln(x) + 23.105
R² = 0.5889
100
1,000
10,000
100,000
Wine production (kL)


Fuel (MJ / kL)
300
250
200
150
100
50
0
Fuel (MJ / KL)
y = -20.08ln(x) + 314.71
R² = 0.4051
100
1,000
10,000
100,000
Wine production (kL)

Waste

- Waste cost per kL of wine – based on **7** wineries.

This report takes into account wastes that are collected (typically for a fee) and transported off-site for disposal or recycling. It does not take into account organic wastes such as stalks, stems and marc that are recycled for other uses on-site or used by the company elsewhere (returned to vineyards, composted, stockfeed, etc.), or collected and used as a raw material for tartaric acid manufacturers.

Solid waste can be divided into two main categories – recycled material and waste to landfill. Wineries tend to have sparse data regarding the quantity of waste generated and the type of waste generated, but cost is typically recorded. Therefore, only the cost of waste management has been used for resource efficiency benchmarking.