A guide to greenhouse gas reduction for South Australian grapegrowers & winemakers

SOUTH AUSTRALIAN WINE INDUSTRY
ASSOCIATION INCORPORATED

Wine Grape Council SA

Government of South Australia

How much greenhouse gas am I emitting - Product versus Business?

There are two ways of looking at measurement of greenhouse gas emissions – those from business activities and those attributed to products.

When counting the emissions from a business, only those greenhouse gases caused directly by the activities owned and controlled by the business are counted in a business footprint. Emissions caused by any suppliers to the business are not counted. The focus of this guide is primarily the emissions from business activities.

When looking at a product the whole of the product's lifecycle emissions are considered in a product footprint. All greenhouse gas released as a result of the production of that product are considered – such as those caused by manufacture of agrichemicals, provision of contract services and even disposal of packaging. In a product footprint the emissions caused by suppliers in providing the goods are included.

Greenhouse Gas is an issue that will affect your business

There is a scientific consensus that greenhouse gas emissions from human activity are contributing to accelerated climate change. As a result:

- Many grape growers and winemakers are expressing their desire to be better environmental stewards by reducing greenhouse gas emissions.
- Some wine consumers are choosing to lower the carbon impact of their lifestyles and are reflecting this in their wine purchase decisions.
- Some wine retailers are encouraging action from winemakers to reduce greenhouse emissions and are also encouraging "carbon labelling".
- The number of wine brands appearing in the market with environmental and carbon claims is increasing rapidly with environmental marketing initiatives by producers.

Response to climate change is expected to impact on the prices of water, fuel and electricity as utilities around Australia invest in lower emission generation technology such as wind, solar, geothermal, and natural gas. A carbon price would also result in an increase in many business inputs.

The greenhouse gas of concern in responding to climate change is largely carbon dioxide (CO_2), but greenhouse gases also include methane, nitrous oxide and many refrigerant recharge gases that also have global warming potential. Nitrous oxide arises from nitrogen fertiliser use and methane from wastewater treatment and waste management. Emissions are usually expressed in units of carbon dioxide equivalents (CO_2-e).

For more information on the greenhouse gases that cause global warming, see SAWIA's fact sheet:
www.winesa.asn.au/media/docs/sector_agreement/information_sheet_5.pdf

Where is the pressure to improve greenhouse gas performance coming from?

In domestic markets, brand owners, marketers and media interest appear to be driving the development of environmental brands. As a result, there is increasing pressure on wine producers and grape growers to report on and reduce their greenhouse gas emissions. Several wine companies have already taken the approach of marketing their greenhouse gas performance.

In the UK and European markets, some retailers (i.e. supermarkets) are putting pressure directly on wine companies to provide products produced with a lower carbon footprint and sometimes labelled as such. The USA is also following this trend as are Korea and Japan. At present, it is the retailers that have been leading the drive, rather than consumers.

In many other markets, particularly emerging markets, carbon does not appear to be an issue for the time being.

Measure → Analyse → Reduce

Three steps to reducing your greenhouse gas emissions

STEP 1: Measuring the greenhouse gas emissions of your business

The checklist below will help you to measure greenhouse gases produced by your business as an overall number. It is relatively simple and is derived from the use of inputs that generate greenhouse gas. Greenhouse gas emissions are calculated by multiplying the amount used by "emission factors" that are specified by Department of Climate Change protocols.

Calculating overall greenhouse gas emissions

First, use this check list and set out the amount of relevant inputs that you have used.

1. From your bills

- Electricity bill(s) – some bills also show the amount of greenhouse gas emissions
- Natural gas bill
- Receipts or supplier invoices for diesel and petrol (these can also be determined from your records if you do not have receipts)
- Any other fuel bills (e.g. LPG, or heavy fuels)
- Invoices for carbon dioxide delivered
- Invoices for refrigerant gas recharge with volume and type of refrigerant gas (these can also be estimated from equipment specifications if you do not have invoices)
- Fertiliser invoices (only if you cannot get this from operational records)

2. From your operational records

- Distance travelled in vehicles owned or leased by you (km and vehicle type – if you do not have receipts or fuel invoices)
- Fertiliser use (if invoices are unavailable)
- Organic waste composted anaerobically – on your site only
- Liquid waste treatment – see below
- Fertiliser applied (amount, percentage Nitrogen and whether vineyards are irrigated or not)
- Solid waste to composting (wet weight)

3. By checking equipment

- Identifying charge size and type of refrigerant in air conditioning and refrigeration units for use in default loss calculations if information about refrigerant gas charge is not available from supplier invoices

Liquid waste treatment is the most complex component of measuring greenhouse gas, but in many cases, it may not be relevant. For the simplest calculation you need to know:

- Total wine production
- Volume of methane/biogas flared

Greenhouse gas is simpler than many people think

Greenhouse gas emissions of wine businesses are mostly caused by use of fossil fuels – diesel, petrol, natural gas, LPG and electricity.

The mix of emission sources in vineyards is dominated by electricity and diesel in a mix that depends heavily on relative levels of machinery and tractor use and water pumping.

Up to 90% of all greenhouse gases from winemaking businesses are from electricity use.

Up to 80% of emissions from small winery/vineyards will be from electricity use.

Emissions from electricity use in vineyards ranges from below 10% to over 50%, with fuel use accounting for 50% to 90% of vineyard greenhouse gases.

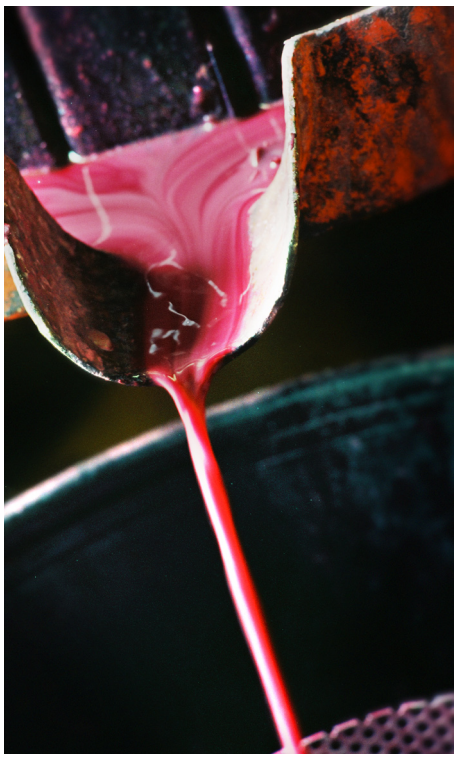
Over 60% of greenhouse gas emissions caused by electricity in a typical winery will be from electricity used in refrigeration.

Additional contributions come from the use of fertiliser, carbon dioxide gas in the winery, refrigerant gas leakage, wastewater and waste management.

There is a strong correlation between energy cost reduction and greenhouse gas reductions. In general, greenhouse gas reduction equates to cost savings.

It is important to keep good records of fertiliser application (i.e. what has been applied to which blocks and when) to accurately account for greenhouse gas emissions from fertilisers. Identifying emissions associated with fertiliser application can be complicated by different emission factors for organic and inorganic fertilisers, identifying the N content of organic fertilisers, and whether it is applied to irrigated or non-irrigated blocks.

Measure → Analyse → Reduce



The Australian Wine Carbon Calculator is an Excel-based carbon calculator (available online from WFA, www.wfa.org.au/entwineaustralia/carbon_calculator.aspx), which can be used to calculate the carbon footprint of your business (using only the Scope 1 and 2 sheets).

This will help identify what proportions each of your business activities are contributing to your total greenhouse gas emissions.

Auditing energy usage

If energy use is a major component of your emissions, a more detailed form of measurement can be achieved through an audit of energy use. In an audit, the overall figures for energy use are broken down into more detail, such as:

- Energy use by appliances such as lights, refrigerators, ovens, water heaters, air conditioners
- Energy use by items of plant such as refrigeration, compressors, centrifuges, pumps
- Energy use by items of equipment such as vehicles, tractors, forklifts, frost control equipment, harvesters, aerators

Energy Audit Standards

Ideally, an energy audit should be conducted according to international standards (Australian/New Zealand Standards AS/NZS 3598:2000) to ensure that a minimum standard is applied.

The standards are relatively straightforward, and they can help you to do the audit yourself.

If you wish to use external consultants for your auditing, you should make sure that they are working to the standard. Furthermore, if you are seeking quotes for such work, some knowledge of the standards may help you to compare quotations.

STEP 2: Analysing the greenhouse gas emissions of your business

Once you have calculated your overall greenhouse gas emissions and potentially completed some energy auditing you will be able to identify some opportunities to improve greenhouse gas performance.

In choosing those with the highest benefit for your business, financial analysis will be an important element and tools that should be considered include payback period and discounted cash flow analysis. An analysis could include:

- Review of your record keeping and data quality
- Benchmarking with similar companies
- Identifying the highest greenhouse gas contributors of your business by both emissions and cost (e.g. refrigeration, lighting, pumping, tractor use…)
- Discussing with suppliers what opportunities they can bring to support your efforts to reduce greenhouse gas emissions and costs
- Seeking information from other companies on what they have done and how it has worked
- Determine if your brand and regional values will support environmental branding
- Determine what you can afford to invest and the return period you need from that investment
- Determine the cost benefit of various approaches
- Identify which of the greenhouse gas opportunities in your business have a net benefit

Personal commitment, brand positioning and brand values may play a part in assessing and prioritising opportunities, however these may be more difficult to quantify. If you decide to go carbon neutral then the costs of carbon credits to offset carbon emissions will become part of the financial analysis.

STEP 3: Reducing greenhouse gas emissions

There are many opportunities to reduce greenhouse gases, which are discussed in the next few pages. Examples include:

- Installing energy efficient light globes
- Efficient equipment use
- Changing start-up and shutdown procedures
- Capital improvement programs – towards improving energy efficiency
- Purchasing green energy

Purchasing Green Energy

Green energy purchases will reduce the greenhouse impact of your business. However, the reduction will not appear in measurements of the greenhouse gas footprint of your business using the emission factors methods as they currently stand, as emission factors are based on state grid emission figures, not the emissions of individual businesses.

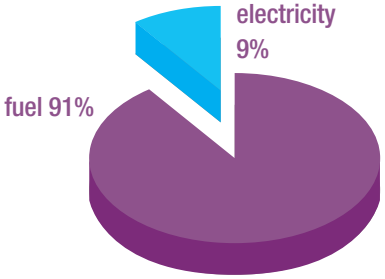


Chart 1 Example of direct greenhouse gas emissions for a small vineyard (Approximately 60 ha, 400 Tonnes; data provided by SAWIA)

Pump performance

Ensuring that fixed-speed pumps are operating in an efficient band of their performance curves will reduce energy use. Pumps that operate at too high or too low a flow against a given head become inefficient, increasing their energy use.

Changing pumps so that both head and flow are within their efficient operating band will improve energy efficiency of the pumps. Where pumps operate across a high range of flows, the use of variable speed drives can improve energy efficiency.

Vineyards and wineries

Opportunities for vineyards and wineries

Overall opportunities to improve the greenhouse performance of wineries and vineyards include:

- Good maintenance – of tractors, vehicles and wine processing equipment
- Solar hot water – can reduce costs by pre-heating water for cleaning
- Installation of variable speed drives and soft start motors
- Energy efficient lighting, natural lighting and directional lighting (tank farms can be high users of lighting)
- Efficient pumping
- Upgrading air conditioning
- Insulation

Chart 1 shows an example of a vineyard where most of the direct greenhouse gases are asscoiated with electricity and fuel. There will also typically be a small contribution from nitogenous fertiliser and potentially waste management. Fuel typically ranges from 50 to 90%.

Vineyard

Improvements in the greenhouse gas performance of vineyards also reduce energy, fuel, water and maintenance costs. So in general, greenhouse gas reduction programs in vineyards will result in savings and performance improvement.

Opportunities for the reduction in greenhouse gases in the vineyard are:

- improving efficiency in vehicle (particularly tractor) use
- efficient generators, pumps and motors
- efficient application of fertiliser
- replacement of generators with solar or solar augmentation

Nitrogen fertiliser application should be optimised to the needs of the vines. Application practices that minimise the loss of fertiliser from the root zone will reduce the greenhouse gas contribution of vineyards.

Pumping (electric and diesel) is a significant contributor to vineyard greenhouse gas emissions. Even though year to year variations in crop water requirements mean that the greenhouse gas contribution of irrigation will vary, the following steps can be taken:

- During transition to drip irrigation, design should ensure that pumping is optimised
- Efficient water use requires less pumping so reducing reliance on imported water will improve greenhouse performance, but will require changes to other management practices such as mulching or inter-row cropping. This can also improve soil nitrogen retention.
- Efficient pump operations (see box on pump performance)

More efficient use of tractor passes including over-the-row (multi-row) mechanical operations and multi-targeted pass operations will contribute to reducing greenhouse gas emissions. Well maintained tractors will also typically be more greenhouse gas efficient.

The following approaches can also be considered:

- Fertigation to replace spreading if there are no other impacts on viticultural practice. Supply of macro nutrients, particularly nitrogen, is suited to fertigation but application of gypsum and lime will still need to be done by granular application
- Minimising prophylactic fungicide application

Winery

Chart 2 indicates the direct greenhouse gas production for a small winery with some vineyards on-site. There will also typically be small contributions from refrigerant gases, wastewater treatment and, potentially, waste management.

Opportunities to reduce greenhouse gases in wineries include:

- Refrigeration
- Compressors
- Wastewater treatment
- Lighting
- Operation of major items of equipment such as centrifuges, membrane filters, pumps, stationary engines

REFRIGERATION

The largest single source of greenhouse gas emissions in wineries is electricity. The most significant user of electricity is refrigeration. Strategies to minimise refrigeration include:

- Increasing fermentation temperature – by even 1°C can make considerable savings
- Increasing coolant brine temperature improves cooling efficiency
- Replacing single brine storage tank systems that mix cool and warm brine in a single brine tank with two tank systems, or unmixed reservoirs
- Improving insulation on tanks and brine lines
- Changing coolants
- Changing pumps, compressors, reservoir sizes and zoning of brine lines

WHAT IS A SOFT START?

A soft start is a device or system on an AC motor (or pump) that reduces the torque delivered to the power train. It reduces mechanical stress on the motor and shaft and electrodynamic stresses on the power system. Soft starters can be mechanical or electrical or a combination of both.

Mechanical devices can be a clutch, fluid drive, shot or magnetic coupling that slowly applies the shaft torque to the load.

Electrical devices can temporarily reduce the voltage or current input, or can temporarily alter how the motor is electrically connected.

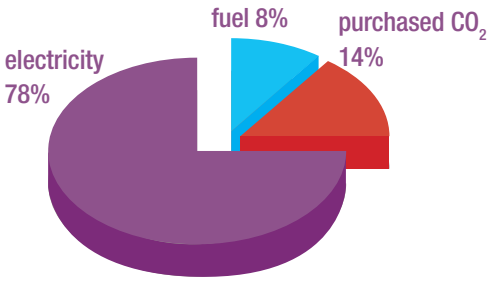


Chart 2 Example of direct greenhouse gas emissions for a small winery (Approximately 800 Tonne total crush; data provided by SAWIA)

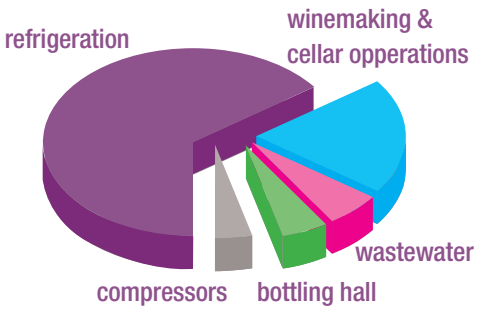


Chart 3 Representative breakdown of electricity use in a winery with a bottling line (Compiled from data provided by WFA on large and medium wineries)

Applications of temporary electricity metering

Temporary metering is an effective tool for identifying opportunities to reduce electricity consumption. Portable meters can be connected to switchboards and to major equipment items and used to monitor:

- Start up and shut-down practices, which can make a significant difference to power consumption of high power equipment such as centrifuges in wineries
- Supplementing information from energy audits by determining exactly which areas are major users of energy
- Reviewing the performance of equipment (e.g. pumps, motors, compressors) in both wineries and vineyards

Temporary and portable electricity meters can be rented from well known providers of technical equipment rental. Many electrical service and consulting providers also have temporary metering equipment.

Increasing fermentation temperature from 14 to 16°C can result in a 10% reduction in refrigeration energy use, and increasing from 16 to 18°C can result in a 20% energy reduction (see: *Maximising Refrigeration Efficiency*, K. Forsyth, V. O'Brien and W. Roget). The reduction in fermentation time of 30 to 40% available from these 2°C changes in fermentation temperature also represents a significant improvement in capital performance (1.5 times as many ferments from existing fermenters).

IMPROVING OPERATIONAL EFFICIENCY

Examples of greenhouse gas savings from operational efficiency include:

- Changing warm-up and warm-down practices on major equipment items – individual item power measurement can facilitate significant performance savings. Major consumers of power include centrifuges, RDV's, membrane filters, crushers and compressors
- Scheduling to minimise equipment start-ups and shut downs
- Replacement of underperforming or poorly sized equipment. Payback periods on reduced maintenance costs and electricity consumption can be short
- Variable speed drives and soft starts
- Recovery of waste heat and waste cold. There are opportunities for waste energy recovery in wineries such as recovery of cooling from cold stabilisation to pre-cool wine moving into cold storage
- Supplementary power generation- Installation of supplementary gas, solar or wind power which will reduce greenhouse gas emissions and also "peak-shave" maximum demand, reducing electricity tariff
- Installation of methane flares on anaerobic wastewater treatment systems
- Improving the efficiency of wastewater systems

TARIFF MANAGEMENT

Some (but not all) tariff management practices can potentially help reduce greenhouse gas emissions, including:

- Increasing off-peak energy consumption
- Power factor correction (aligning current and voltage)
- Minimising (or "peak-shaving") maximum demand
- Becoming active in tariff management
- Substitution, Co-generation and tri-generation

For further information on tariff management, see *Responding to Electricity Price Increases*, D. Oemcke & K. Forsyth.

Telling the world what you are doing

Carbon-oriented environmental claims

A number of South Australian wines and suppliers to SA wine enterprises utilise carbon based environmental claims to support the marketing of their wines. Some wine companies have become carbon neutral, others have implemented and publicised changes in production, processing or transport.

Carbon Neutral

"Carbon neutral" can refer to specific products or to the business as a whole.

Carbon Neutral Businesses

A carbon neutral business is one that has purchased enough carbon offsets to balance the emissions that they produce within their business. ISO Standard 14064 provides guidance to companies wishing to make carbon neutral claims about the company/ enterprise and for monitoring and recording the improvements in their greenhouse gas emission performance.

Several Australian viticulture wine companies have carbon neutral business certification.

Carbon Neutral Products

To be carbon neutral a product must have its lifecycle greenhouse gas contribution assessed, possibly minimised, and then offsets purchased for the greenhouse gas generated in the production of the wine.

The Australian National Carbon Offset Standard requires that product carbon neutrality claims must use Life Cycle Assessment techniques to estimate the carbon produced during the product life-cycle. They recommend ISO 14044, which includes a third party peer review stage to ensure all emissions have been accurately accounted.

UK supermarkets may have a preference for British Standards Institute PAS 2050 compliant lifecycle assessment.

Carbon labelling

Recent research suggests that about 40% of Australians are prepared to pay a premium for low Carbon or Green products and services (The L.E.K. Consulting ANZ Carbon Footprint Report 2009).

The purpose of a carbon label is to communicate to the consumer the carbon impact of particular products to give consumers an opportunity to make informed decisions on the items they purchase.

Internationally, retailers are increasingly investing in the development of carbon labelling programs for food and grocery items.

Life Cycle Assessment

Carbon labelling requires a lifecycle assessment, i.e. “cradle to grave” approach to determining all greenhouse gas emissions associated with production, use and disposal of the wine.

Chart 4 shows a hypothetical representation of the proportion of greenhouse gas emissions for the whole of lifecycle elements of a wine produced by a typical small winery for an overseas market. The relative importance of the winery and vineyard are shown, with packaging and distribution about half of the lifecycle contribution.

The greenhouse gas contributions from distribution are: transport to wharf, shipping and distribution in market by truck and train.

The main greenhouse gas contributions from packaging are from the manufacture and delivery of packaging (in this example full weight glass).

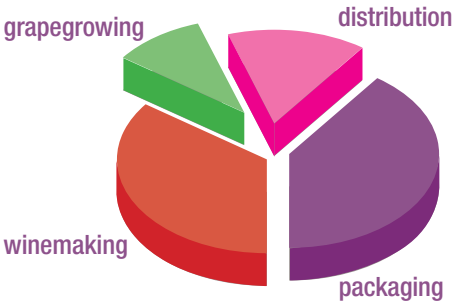


Chart 4: Hypothetical representation of the lifecycle contributions of wine produced by a small winery for an overseas market

Opportunities to reduce packaging and transport inputs

The most significant options to reduce greenhouse gas production in transport and packaging are:

- Lightweight glass - Australian glass manufacturers produce a range of lightweight wine bottles that reduce the greenhouse gas impact of glass manufacture and glass transportation.
- PET and other non-glass wine packaging has been implemented by a number of wineries to reduce the greenhouse gas contribution of both packaging manufacture and transportation.
- Improving logistics and planning when transporting wine (packaged or in bulk) can offer further savings. Transportation costs (particularly overland by truck) can be greenhouse intensive.

Resources

Publications

A Guide to Energy Efficiency Innovation in Australian Wineries: Energy Efficiency Best Practice, Commonwealth of Australia Department of Industry Tourism and Resources, 2003 (download from: www.ret.gov.au/energy/efficiency/eeo/pages/default.aspx by typing wineries in the search line)

Footprints, Food Miles and Furphies, Australian Society of Viticulture and Oenology Seminar Proceedings, 2008

Impact on Australian Viticulture from Greenhouse Induced Temperature Change, L.B. Webb, P.H. Whetton and E.W.R. Barlow, www.mssanz.org.au/modsim05/papers/webb_lb.pdf

Maximising Refrigeration Efficiency, K. Forsyth, V. O'Brien and W. Roget, Poster Presented at the 14th Australian Wine Industry Technical Conference, 2010

Red, White and "Green": The Cost of Carbon in the Global Wine Trade, T. Colman & P. Päster, American Association of Wine Economists Working Paper No. 9, 2007

Responding to Electricity Price Increases, D. Oemcke & K. Forsyth, Wine Industry Journal 24(4):19-27, 2009

The L.E.K. Consulting ANZ Carbon Footprint Report 2009, www.lek.com/content/anz-carbon-footprint-report-2009

On the WWW

The Australian Wine Carbon Calculator, www.wfa.org.au/entwineaustralia/carbon_calculator.aspx

Wine Industry Sector Agreement, www.winesa.asn.au/sector-agreement/

or, www.wgcsa.com.au/page.php?key=climate_change

GRANTS

Two AusIndustry Grant programs targeted at small and medium sized businesses are Re-Tooling for Climate Change and Climate Ready. Information is available on www.ausindustry.gov.au/ClimateChange/Pages/ClimateChange.aspx

AUSTRALIAN GOVERNMENT POLICY

Department of Climate Change, www.climatechange.gov.au

National Greenhouse Accounts (NGA) Factors, www.climatechange.gov.au/publications/greenhouse-acctg/national-greenhouse-factors.aspx

ENVIRONMENTAL CLAIMS

Carbon Claims and the Trade Practices Act, www.accc.gov.au/content/index.phtml/itemId/833279

The "Six Sins of Greenwashing" www.terrachoice.com/files/6_sins.pdf

CARBON OFFSETS

National Carbon Offset Standard, www.climatechange.gov.au/en/government/initiatives/national-carbon-offset-standard.aspx

Carbon offset guide Australia, www.carbonoffsetguide.com.au

ENERGY EFFICIENCY

Greenpower Accredited Renewable Energy, www.greenpower.gov.au

Energy Efficiency www.ret.gov.au/energy/efficiency/eeo/pages/default.aspx

NGER (NATIONAL GREENHOUSE ENERGY REPORTING)

To work out if you need to report: www.climatechange.gov.au/en/government/initiatives/national-greenhouse-energy-reporting/business-need-to-report.aspx

Relevant Standards

Energy Audits AS/NZS 3598:2000

Quantification and Reporting of greenhouse gas emissions and removals ISO 14064-1:2006

Quantification and Reporting of Greenhouse Gas Emission Reductions and Removal Enhancements ISO 14064-2:2006

Validation and Verification of Greenhouse Gas Assertions ISO 14064-3:2006

Life Cycle Assessment ISO 14044:2006

Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling) ISO 14021:1999

Environmental labels and declarations — Type I environmental labelling – Principles and procedures ISO 14024:1999

Environmental labels and declarations — Type III environmental declarations ISO 14025:2006

Greenhouse gases — Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition ISO 14065:2007

Assessing the Life Cycle Greenhouse Gas Emissions of Goods and Services British Standards Institute PAS 2050

Calculating greenhouse gas emissions - Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006: Agriculture, Department of Climate Change and Energy Efficiency

Calculating greenhouse gas emissions – National Greenhouse Accounts (NGA) Factors, Department of Climate Change and Energy Efficiency

For Help

South Australian Wine Industry Association – Environmental programs – see: www.winesa.asn.au

Wine Grape Council of South Australia – Climate Change programs – see: www.wgcsa.com.au

Winemakers Federation of Australia – Entwine Australia – www.wfa.org.au/entwineaustralia

WISA (Wine Industry Suppliers Australia) can direct you to a member to help you with Energy Auditing, Environmental Branding, Life Cycle Assessment and Energy Efficient Products – see: www.wisa.org.au

Grape and Wine Research and Development Corporation – see: www.gwrdc.com.au – Innovators Network and links to research providers, including: The University of Adelaide (www.adelaide.edu.au), SARDI (www.sardi.sa.gov.au/), National Wine and Grape Industry Centre (www.csu.edu.au/research/nwgic/), The Australian Wine Research Institute (www.awri.com.au)

Wineries can benchmark energy use against other wineries – see: www.benchmarker.com.au or www.arris.com.au

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