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Australian Government

Grape and Wine Research and Development Corporation

Wine Industry Greenhouse Gas Training Course



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ACKNOWLEDGEMENTS

The development of this training manual builds on a foundation of effort by individuals and organisations in the international wine industry.

The first building block of the manual was in the visionary international project to develop the FIVS International Wine Carbon Calculator (IWCC). The partners in this project were The Winemakers Federation of Australia, The Wine Institute of California, New Zealand Wine Growers and Integrated Production of Wines South Africa. The IWCC calculator is understood to be the first attempt to develop an international carbon calculator for any industry sector, with the protocol adopted formally by FIVS and the calculator, or approaches derived from the calculator, used in many wine producing companies. Amy Russell from the Winemakers Federation of Australia played a pivotal role in the development of the calculator and protocols.

The second building block has been the contribution by Yalumba of all of their corporate lifecycle analysis data, life cycle assessment experience and their practical support through Cecil Camilleri. This accelerated the development of the international calculator and integrated on-the-ground experience into the project.

The third building block has been the “early adopter” companies that have worked with Provisor to develop their responses to the challenge of climate change. These clients cannot be named here, but our learning together has significantly enriched this training manual. (Note that all winery specific emissions data contained in the manual is not based on actual studies and is for example purposes only).

This final building block has been the Grape and Wine Research and Development Corporation for seeing the implementation/extension gap in the Australian industry and for funding the development of the manual and for establishing the Industry Reference Group, consisting of:

- Troy Fischer, Grape and Wine Research and Development Corporation;
- Con Simos, Australian Wine Research Institute;
- Suzanne Mcloughlin, Fosters Group;
- John Blumson, Zero Waste SA;
- Nicola Kelly, Department of Primary Industries and Resources SA;
- Kris Roberts, Department of Primary Industries and Resources SA; and
- Mark Krstic, Grape and Wine Research and Development Corporation

PREFACE

The Grape and Wine Research and Development Corporation (GWRDC) identified that the current wine industry knowledge of greenhouse gas accounting and carbon management was both fragmented and inconsistent, particularly within small to medium sized wineries. As climate change and greenhouse gas accounting methods will have an increasing effect on the way the Australian wine industry performs in the international marketplace it was deemed necessary to improve this knowledge base.

Provisor was contracted by the GWRDC to develop a structured course as an introduction to greenhouse gas accounting and carbon management to ensure that participants are properly equipped to tackle the challenges ahead. The IP for the structured course is therefore held by the GWRDC on behalf of all industry participants and can potentially be delivered by any qualified providers as chosen by industry.

The curriculum was developed with the assistance of the Industry Reference Group, and is divided into four modules:

1. Understanding Climate Change
2. Carbon Accounting Methods
3. Industry Application: Regulations and Guidelines
4. Calculating your Carbon Footprint

The broad aims of the course are to educate participants on the potential effects of unmitigated climate change, the current state of compulsory and voluntary reporting schemes in the relevant domestic and international markets and to introduce methods to estimate greenhouse gas emissions at the facility and product level.

The training is primarily aimed at wine producers, although the course also contains material that would be relevant to grape growers. The course contains material relevant to personnel responsible for the business direction, marketing, financial and operational accounting systems and for the day-to-day operations.

Adapting to a low emissions economy, required to avoid dangerous levels of climate change, will require major changes in the way we operate our businesses, the technology we use and how we go about our daily lives. These changes will take time; but the need for action is urgent. This course is a starting point to encourage thought and discussion, and to improve the understanding of the sources of emissions in the Australian wine industry.



Dr John Harvey
Executive Director
GWRDC

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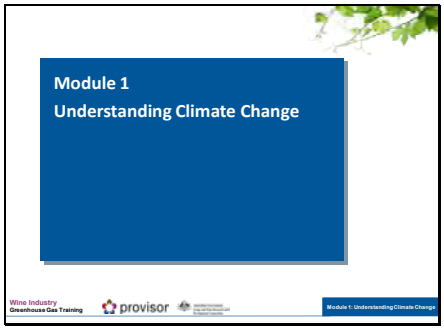
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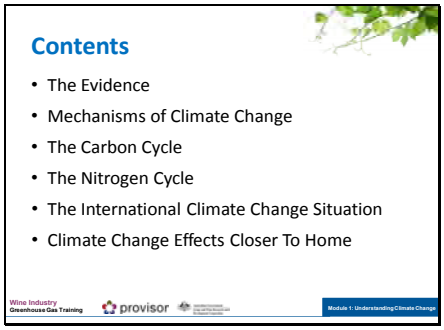
Module 1

Understanding Climate Change

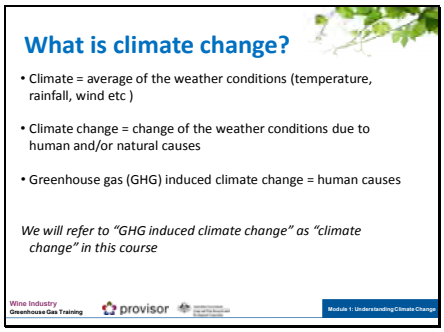
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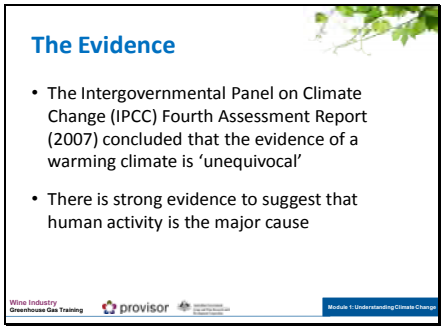
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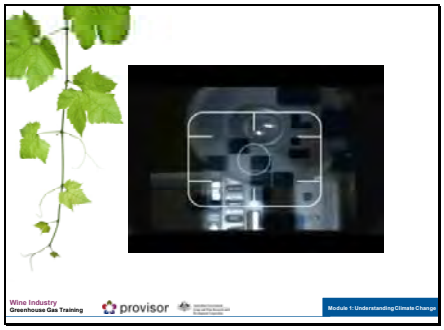
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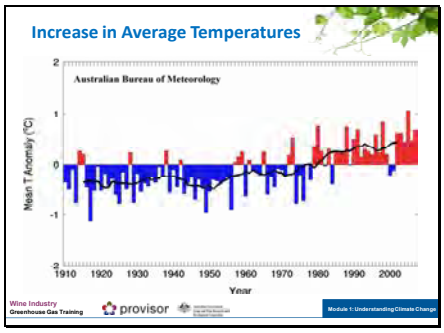


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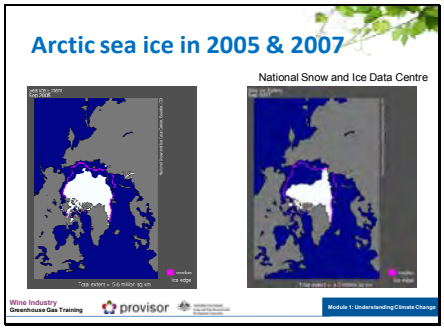
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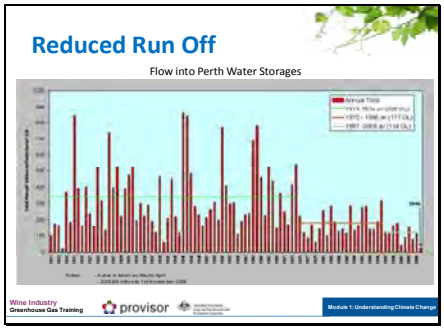
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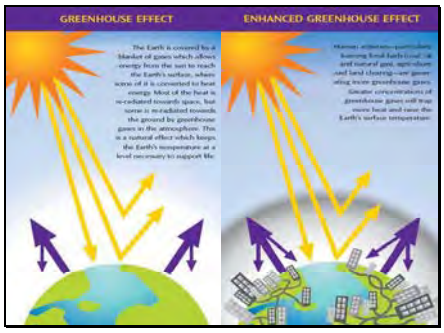
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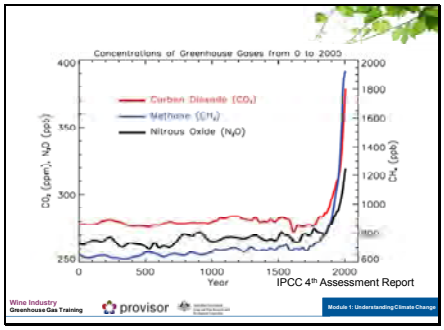
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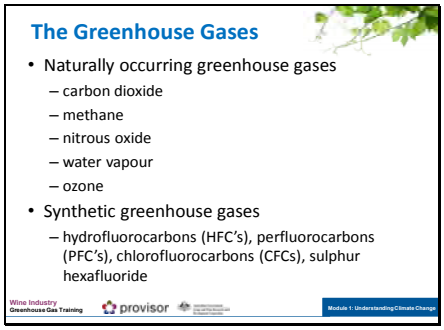
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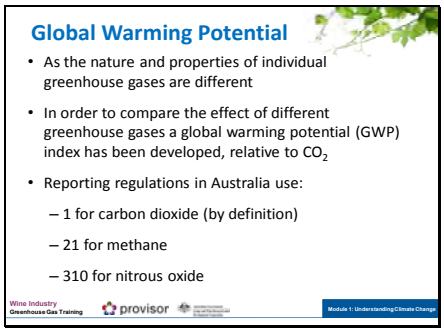
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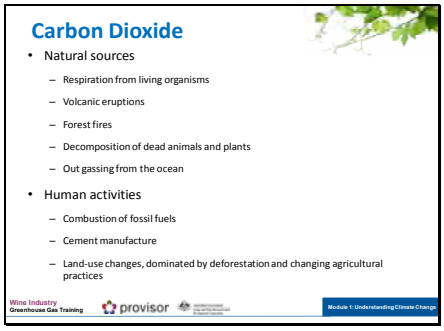
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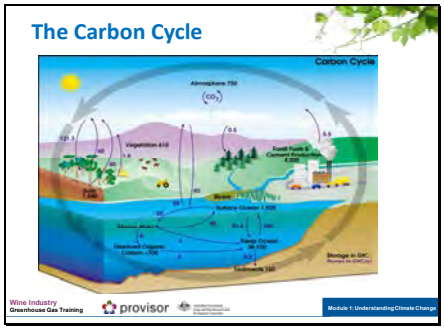
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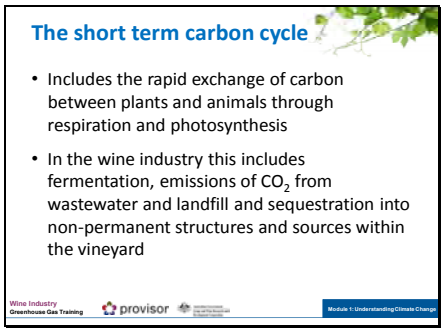
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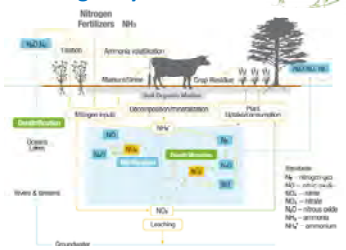
The short term carbon cycle

- Emissions of CO_2 that arise directly from the combustion or degradation of biomass are treated as part of the short-term carbon cycle
- Methane and nitrous oxide emissions from vineyards, wastewater, solid waste and the combustion of biomass fuels are not part of the short-term carbon cycle but are included as emissions sources

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The nitrogen cycle



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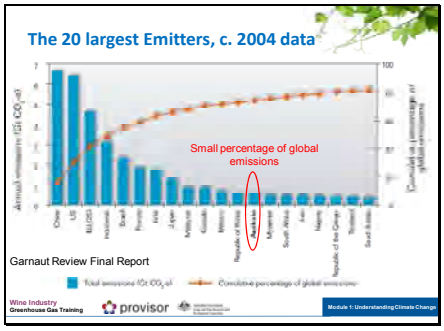
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Uncertainties

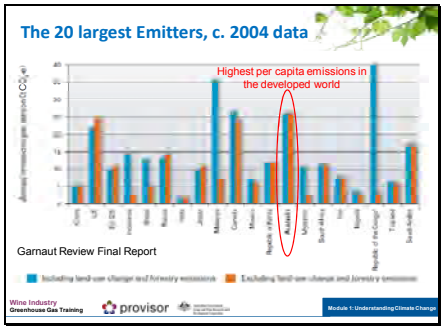
- There are still many people who debate that climate change is occurring
- However, this is against a strong body of scientific evidence
- There is a chance the views of the IPCC are wrong, but the risk is too high to take the view of a minority of sceptics
- Uncertainty is still high, and scientific research is continuing

Wine Industry Greenhouse Gas Training provisor Module 1: Understanding Climate Change

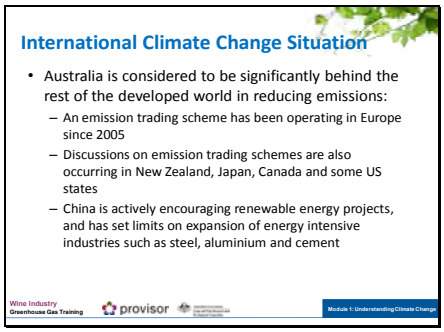
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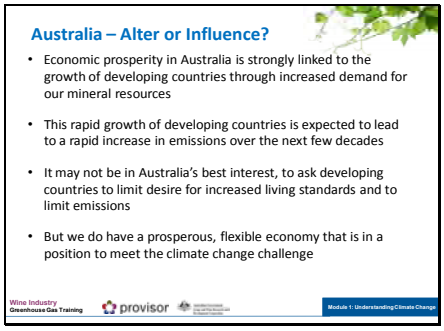
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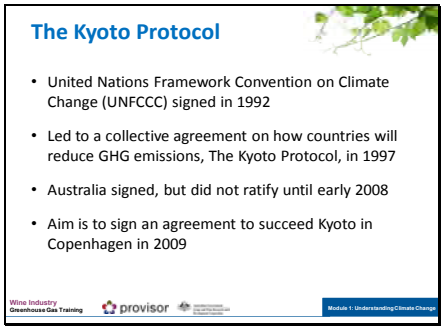
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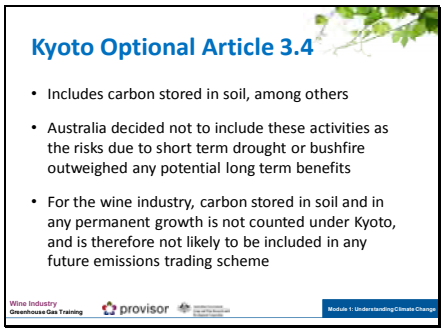
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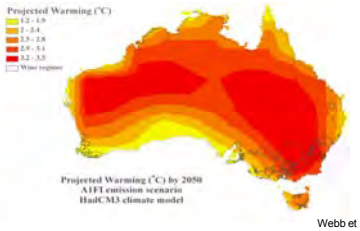
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Climate Change Effects Closer To Home

- Climatic variables that are important to grape production include:
  - Temperature
  - Rainfall evaporation difference (aridity)
  - Humidity
  - Solar radiation

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Projected January warming for Australia



Webb et al 2008

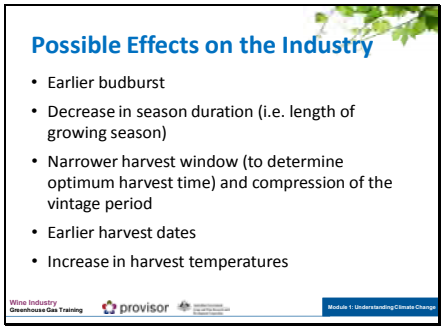
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Projected Change in Growing Season Rainfall

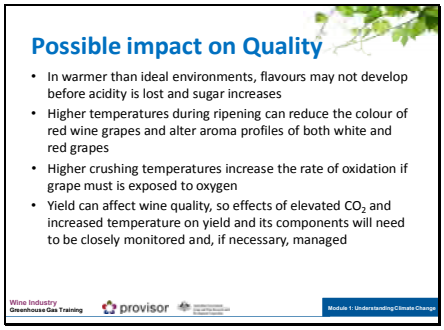
Region	Range of percent change to growing season rainfall (%) *	
	2030	2050
Clare Valley	-9.2 to -0.7	-21.3 to -1.3
Coonawarra	-9 to -1.4	-21.6 to -2.3
Riverina	-6.6 to 0	-16 to -0.2
Hunter Valley	-1.6 to 4.1	-2.6 to 9.9
Yarra Valley	-7.2 to -0.3	-17.4 to -0.6
Margaret River	-15 to -1.1	-36 to -2.2
Vic/NSW Murray Valley	-8.2 to -0.3	-19.9 to -0.5
Granite Belt	-3.4 to 3.3	-8.3 to 8.2
Tasmania	-5.6 to 0.8	-13.5 to 2.1

*Negative number indicates dryer, positive number indicates wetter.

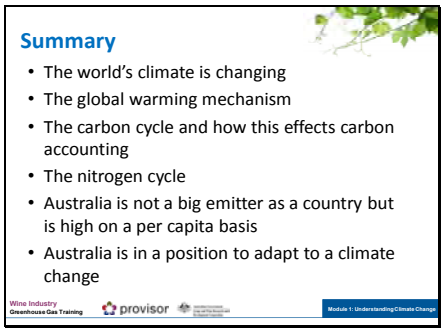
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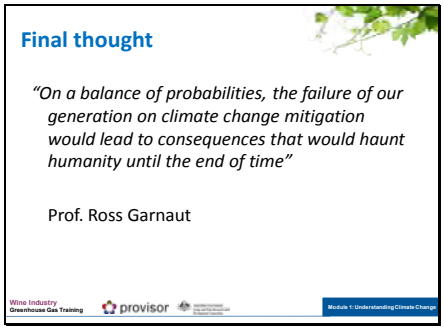
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Slide 34


Final thought
"On a balance of probabilities, the failure of our generation on climate change mitigation would lead to consequences that would haunt humanity until the end of time"
Prof. Ross Garnaut
Wine Industry
Greenhouse Gas Training
provisor
Module 1: Understanding Climate Change

THE EVIDENCE

The world's climate is changing. In the last few decades, droughts have increased, storm events have increased and rainfall patterns are changing. These effects are all considered 'elements' of climate change. But what is climate change?

Firstly, we must understand what is meant by 'climate'. In a broad sense, climate is the average of the weather conditions, and is described by the combination of measurements of temperature, rainfall, wind etc. as these vary spatially.

A change in average weather conditions over time can occur due to natural events, such as volcanic eruptions or variations in solar radiation. Recently, as well as these natural causes, changes in climate have also been attributed to human activity, or anthropogenic causes. The definition of climate change can include only human causes (referred to as greenhouse gas induced climate change), or both human and natural causes. For the remainder of this document, use of the term 'climate change' will be referring to greenhouse gas induced climate change.

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (2007) concluded that the evidence of a warming climate is 'unequivocal' (1). There is strong evidence to suggest that human activity, namely, the production and release of greenhouse gases into the atmosphere, is the major cause of climate change (1). Major evidence of climate change occurring around the world includes:

- Arctic Sea ocean ice and glaciers diminishing;
- Increased severe weather events;
- Increase in average temperatures; and
- Reduced rainfall run off.

Australia's Changing Climate

Australia's annual mean temperature for 2007 was 0.67°C above the standard 1961-90 average, making it the nation's sixth warmest year since comparable records began in 1910 (9).

In sixteen of the past eighteen years, Australia's annual mean temperature has been higher than normal. (9)

Many centres, especially in South Australia, set records (for any time of year) for numbers of consecutive days with temperatures above specified thresholds. Most significantly, Adelaide had 15 consecutive days of 35°C or above and 13 consecutive days of 37.8°C or above, breaking the previous records of 8 and 7 days respectively (52).

South eastern Australia has been deprived of the equivalent of an average year's rainfall over the past eleven years, making the current drought one of Australia's most severe on record; comparable with the Federation drought in terms of rainfall deficiencies. However, the latest drought is notable for its record high temperatures and record low inflows to water storages (9)

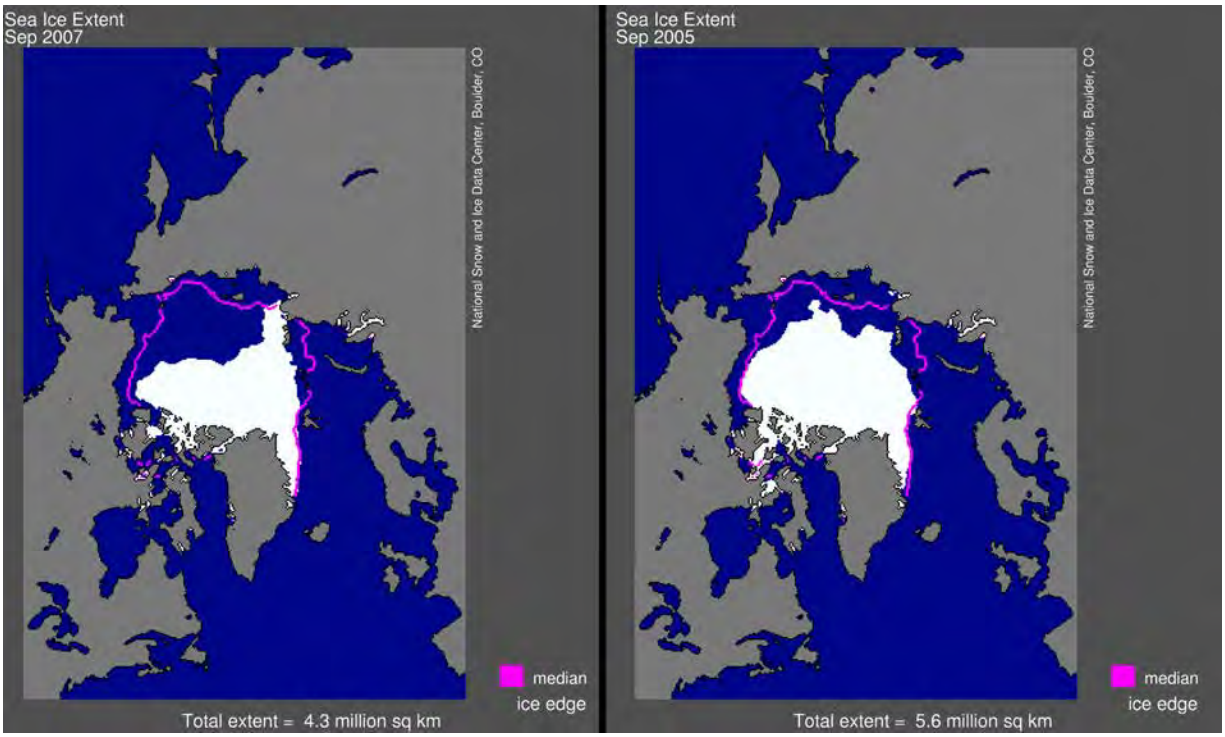
ARCTIC SEA OCEAN ICE AND GLACIERS DIMINISHING

One of the most alarming and prominent indicators of climate change is the increasing rate at which the Arctic ice caps and glaciers, throughout the world, are melting. Scientists at the National Snow and Ice Data Centre (NSIDC) observed the lowest levels of Arctic sea ice at the end of the 2007 melt season since recording began in 1978, with levels at the end of the 2008 season only slightly higher, despite cooler temperatures and ice-favouring conditions (2).

The satellite images in Figure 1 from the NSIDC show the extent of Arctic sea ice decrease at the end of the melt season in 2005 and 2007.

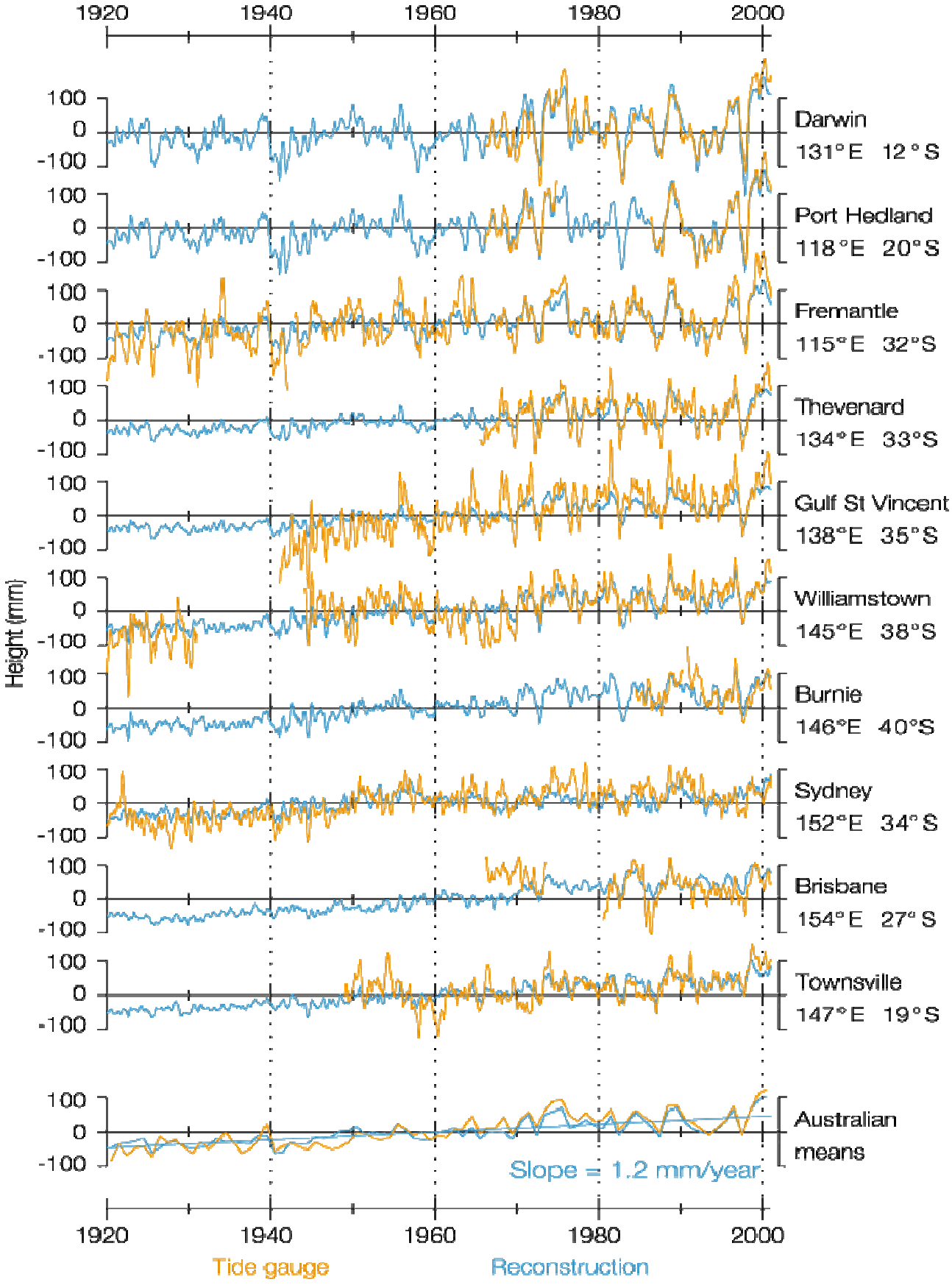
Scientists predict that within a few decades there may be no ice in summer in the arctic for the first time in 1 million years. This would continue to have a devastating effect on arctic wildlife, such as polar bears, which are unlikely to survive as a species if the sea ice disappears completely (3).

Figure 1 – Satellite Images showing depletion of Arctic sea ice between 2005 and 2007, NSIDC (4)



Due to thermal expansion, and to a lesser extent glacial melting, mean sea levels have risen about 1.2mm/yr during the 20th century (5), though this rise is subject to large regional variability. These changes to sea level are projected to continue, and this would see inundation of low lying coastal terrain, most notably when the sea level rise is combined with storm surges. Figure 2 illustrates how the sea level has increased around Australia since 1920.

Figure 2 – The series of graphs indicate tide gauge heights measured from 1920 to 2000. The brown lines are observed data, and the blue lines are reconstructed data (see Church et al. 2004) (6)



INCREASED SEVERE WEATHER EVENTS

The number of weather related disasters reported, such as droughts, tsunamis, hurricanes, typhoons and floods has risen to over 300 a year since 2000 compared to approximately 100 reported disasters in 1980 (7). In Australia, while events such as these are common it is difficult to attribute an individual event, by itself, to climate change (5). While there is evidence of an increase in extreme rainfall in some regions (e.g. Figure 3) there is as yet no conclusive evidence to link these events to increasing greenhouse gas concentrations.

Figure 3 – The city of Mackay in January 2008



QLD Emergency Services

Similarly, rainfall reductions that have resulted in the recent drought conditions in south eastern Australia (2001-2008) have been studied. Although there is some evidence that these reductions are linked to climate change, the mechanisms driving the change are not fully understood, and consequently a definite link has not been reported (8).

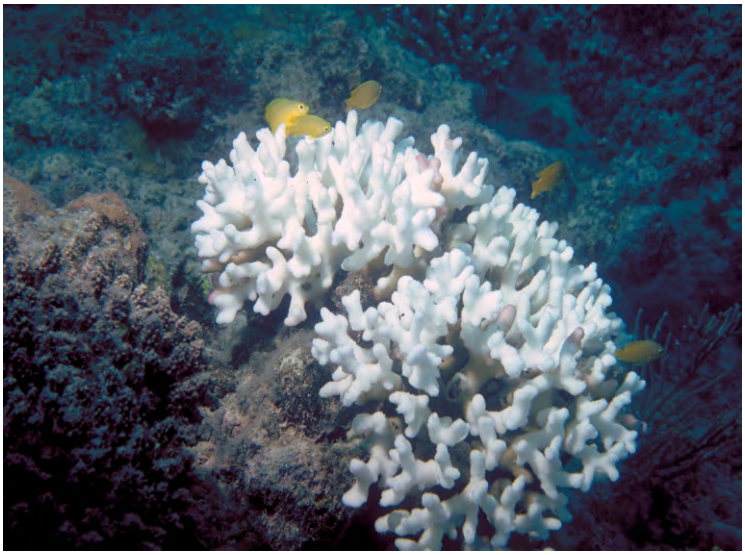
Climate models predict that droughts will become more extreme and could be as much as 20% more frequent over much of Australia by 2030 and up to 80% more frequent in south western Australia by 2070. Similarly, increases in extreme rainfall events and hence flooding are predicted for many regions (5).

INCREASE IN AVERAGE TEMPERATURES

Australia's mean temperatures (average of minimum and maximum temperatures) have been steadily increasing over recent years (9). Recent increases in the annual mean temperature for Australia are evident. In the last 3 decades, 83% of the annual mean temperatures have exceeded the average temperature (average of 1961-1990 mean temperatures).

Rising sea temperatures and acidity are affecting the world's coral reefs, including Australia's Great Barrier Reef. Reef-building corals have already been pushed to their thermal limits by increases in water temperatures over the past 50 years (10), leading to events such as coral bleaching (Figure 4). At a carbon dioxide concentration of 450 parts per million (ppm), the diversity of corals on reefs will decline, while atmospheric carbon dioxide concentrations as low as 500 ppm will result in coral communities that no longer produce sufficient calcium carbonate to be able to maintain coral reef structures (10).

Figure 4 - Yellow Damselfish swim amongst branches of a bleached Acropora coral.



Great Barrier Reef Marine Park Authority

Internationally, changes have been observed in the locations of populations of aquatic species with certain species shifting as ocean temperatures become warmer or cooler.

REDUCED RUN OFF

Reduced run off has been observed in many catchments in Australia due to changes in rainfall and increases in evaporation (11). In some cases this reduction has been severe and has impacted dramatically on the water inflows into dams which supply communities with water. Currently, many Australian regions are experiencing water restrictions due to reduced water storages. Figure 6 highlights the reduction in mean inflows into Perth dams over the last century. Average inflows during 1997-2005 were only 64% and 34% of that observed during 1975-1996 and 1911-1974, respectively. A decline in rainfall of 10-20% has seen a magnified reduction in dam inflow by 30-60%.



fotolia

Figure 5 – Australian Annual Mean temperature anomaly (base 1961-1990). Black line shows 11 year running average (12)

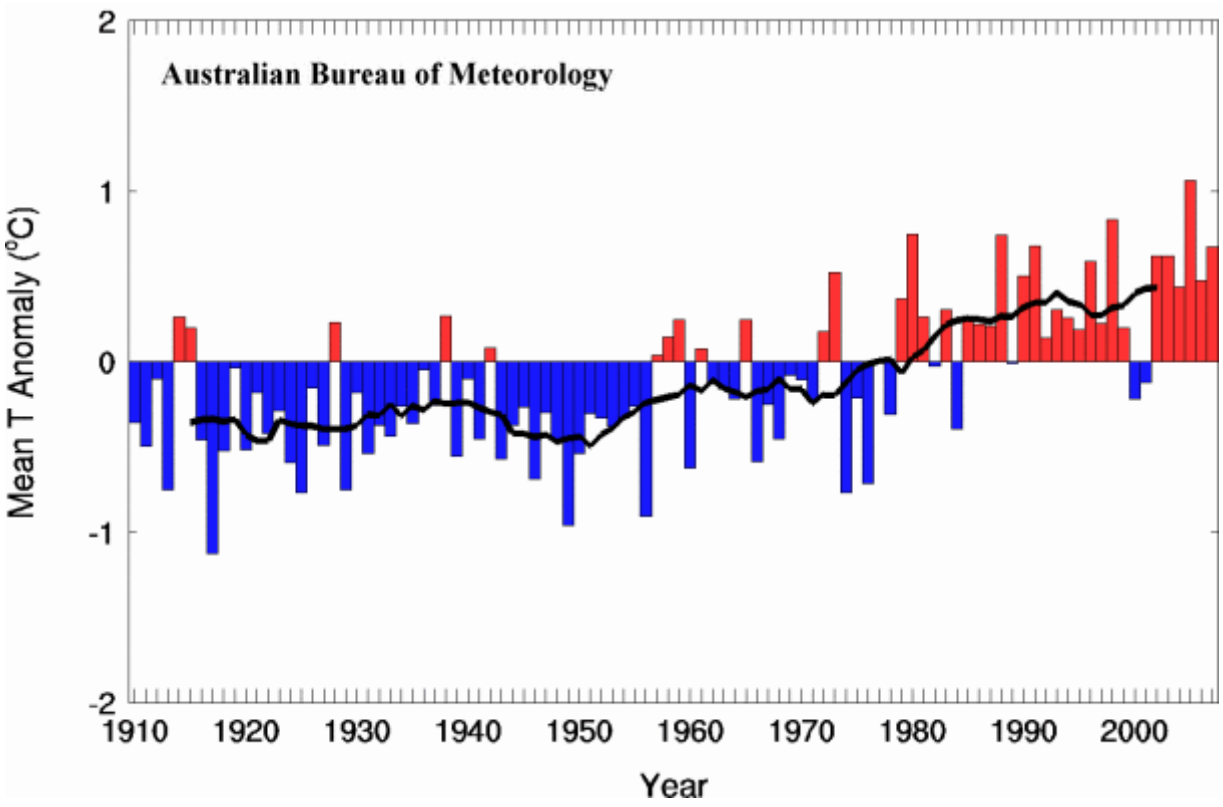
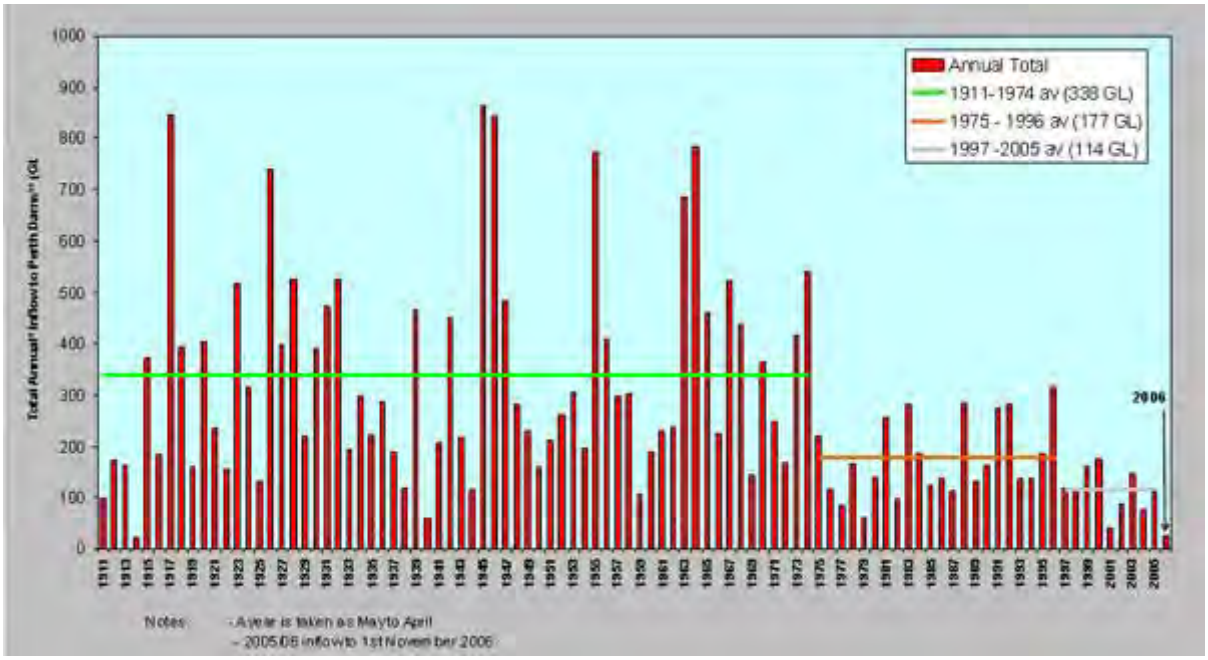


Figure 6 – Stepwise changes to dam inflows, Perth (13)



UNCERTAINTIES

There are still many people in the general public who debate that climate change is occurring. There are many reasons a person may choose to take this position, but it is against the strong body of scientific evidence. While the evidence presented in this chapter is only a brief summary of the research that has been conducted, and is focussed on Australian observations, international scientific consensus supports the claim that that the average global temperature is increasing (1).

There is a chance that the views on climate change of the Intergovernmental Panel on Climate Change and the learned academies in all of the main countries of scientific achievement are wrong. But to heed instead the views of the minority of genuine sceptics in the relevant scientific communities would be imprudent beyond the normal limits of human irrationality. It is prudent to give the major weight to the mainstream science (14).

There are nevertheless large uncertainties in climate change science. While there is a clear majority view that there are high risks, there is debate and honest recognition of limits to knowledge about the times and ways in which the risk will manifest itself (14).

THE INTERNATIONAL CLIMATE CHANGE SITUATION

Although climate change is now a major focus of attention in Australia, we are significantly behind most of the rest of the developed world in reducing emissions (15). An emission trading scheme has been operating in Europe since 2005, and a number of states in the USA, such as California, have emissions reductions programs. Discussions on an emission trading scheme in New Zealand, Japan and Canada are at a similar stage to those in Australia.

In the developed world, China is actively encouraging renewable energy projects, and has set limits on expansion of energy intensive industries such as steel, aluminium and cement manufacturing (15). Other developing countries have said that they will do more on reducing emissions if the developed world leads the way.

In his supplementary draft report, Professor Ross Garnaut said *"Australians can think of many reasons why their situation is different from that of other developed countries, and why their emissions reduction targets should be less demanding. So can people from every other country. There will be no progress towards an effective international agreement if each country lays out all of the special reasons why it is different from others, and why it should be given softer targets."* (14)

AUSTRALIA – ARE WE IN A POSITION TO ALTER OR INFLUENCE?

Australia has to place itself in a position to alter or influence climate change. Australia will continue to experience weather extremes that will impact on our economy and way of life. Australia's location means it is already a hot and dry country and small variations in climate will be more damaging to us economically than many other countries (14). Drought leads to crop failure, stock losses and increases the likelihood of fires, dust-storms and general land degradation. Low rainfall will result in reduced run off into dams which will impact on water availability for human use. Life can't be sustained without sufficient food and water supplies.

Australia's greenhouse gas emissions make up a small percentage (approximately 1.5%) of worldwide emissions (14). However, Australia has the highest greenhouse gas emissions per person in the developed world, excluding land-use change and forestry emissions.

As Australia produces such a small percentage of global emissions, reduction in Australia's emissions alone will not have a significant impact. Australia needs to assist other countries to reduce their emissions to have a positive impact on global emissions.

At the United Nations meetings in Kyoto in 1997, developed countries, including the US and Australia, agreed that they would take the first steps towards reducing emissions (14). Australia's refusal to ratify the Kyoto protocol prior to 2007 is considered to have stalled progress on reaching a comprehensive global agreement on emissions reductions.

The current economic prosperity in Australia is strongly linked to the recent growth of developing countries, led by China, through increased demand for Australia's abundant mineral resources (10).

This rapid growth of developing countries is expected to lead to a rapid increase in emissions over the next few decades. This rapid increase is what makes action to avert dangerous climate change urgent.

It is not fair, nor is it in Australia's interest, to ask developing countries to limit their hopes for an increase in living standards to achieve emissions reductions.

Australia is in a strong position to meet the climate change challenge, with a prosperous, flexible economy. Any action that we take can be viewed as a reinvestment of the profits from developing country growth, contributing to a reduction of the emissions from that growth.

THE KYOTO PROTOCOL

In 1990, the United Nations General Assembly commenced work on a climate change convention. The result was 154 countries signing the United Nations Framework Convention on Climate Change (UNFCCC) at the UN Summit in Rio de Janeiro in 1992. Since then, 189 countries including the USA have ratified the convention.

The goals of the climate change convention are to stabilise the amount of greenhouse gases in the atmosphere at a level that prevents dangerous human-induced climate change.

Each year, a Conference of the Parties is held, where the countries that have ratified the Convention meet and discuss how steps to reach the Convention's goals can be implemented in practice.

In December 1997 the 3rd session of the Conference of the Parties to the Framework Convention on Climate Change (COP3) was held in Kyoto, Japan. Before and during the conference, negotiations on how countries will reduce and/or limit the production of greenhouse gases formed the basis for the collective agreement known as the 'Kyoto Protocol'.

Key terms agreed in the Kyoto Protocol include (16):

- To collectively reduce greenhouse gas emissions below 1990 levels by 5.2% between 2008 and 2012;
- Agreement to allow aggregate targets of country groups (i.e. The European Union (EU) agreed to a collective emission reduction target);
- The allowance for obtaining credit for reductions in greenhouse gas emissions from creation of greenhouse sinks or from changes in land clearing;
- Coverage of six greenhouse gases; and
- No agreement on emission reduction goals for developing countries was made, but it was agreed that developed countries could obtain credit for assisting developing countries.

Article 3.4 of the Kyoto Protocol (39)

Article 3.4 of the Kyoto protocol gives an option for countries to include additional activities towards their emissions targets. These activities include

- plantation forests established before 1990 and all native forests under some form of management;
- revegetation that does not meet forest criteria;
- carbon stored in soil and vegetation on grazing land; and
- carbon stored in soil and crops.

To determine obligations, the emissions from these activities during the commitment period are compared to 1990 levels multiplied by 5. In Australia, 1990 was a wetter than average year, leading to high growth and low emissions. Drier conditions during the 2008-2012 commitment period could therefore lead to significant reportable emissions.

Australia decided not to include these activities in its Kyoto Protocol commitments as the risks of substantial variation in emissions due to short term drought or bushfire outweighed any potential long term benefits.

For the wine industry, this means that carbon stored in soil and in any permanent growth is not counted towards Australia's Kyoto obligations, and is therefore not likely to be included in any future emissions trading scheme.

Australia agreed to limit itself to an 8% increase in greenhouse gas emissions above the 1990 level during the period 2008 to 2012 (16)

Australia signed the protocol at Kyoto but it wasn't until late 2007 that Prime Minister Kevin Rudd signed to ratify the agreement.

During the last Conference of the Parties in Bali 2007, (COP13), a commitment was made to work towards an agreement to succeed the Kyoto Protocol. The aim is to sign the agreement at the Conference of the Parties to be held in Copenhagen (COP15) in late 2009.

There is a chance that an international agreement will be reached that will limit emissions to avoid the effects of dangerous climate change.

CLIMATE CHANGE EFFECTS CLOSER TO HOME

We have already briefly touched on climate change effects on Australia, but how is climate change likely to impact on the grape and wine industries in the future?

Climatic variables that are important to grape production include:

- Temperature;
- Rainfall evaporation difference (aridity);
- Humidity; and
- Solar radiation.

Several studies have been undertaken to model future climatic changes to mean average temperatures and rainfall patterns across Australia (5) and in Australian wine regions (17) using various greenhouse gas emission scenarios. The major findings are as follows:

- By 2030 and 2070, average annual temperatures in Australia will increase by 0.4 to 2.0°C and 1.0 to 6.0°C, respectively (5);
- By 2030 and 2050, average annual temperatures in many Australian viticultural areas will increase by 0.2 to 1.1 °C and 0.4 to 2.6 °C, respectively (17);
- Temperature increases will be highest during summer and lowest during winter;
- Decreases in total rainfall across most wine growing regions of Australia (Table 1); and
- An increased frequency of extreme rainfall events which may result in increased flooding, landslides and/or erosion.

Figure 7 – Projected January warming for Australia calculated using the HadCM3 climate model and the A1FI greenhouse gas emission scenario (see Webb et al. 2008). Wine regions are marked in grey on the map (18)

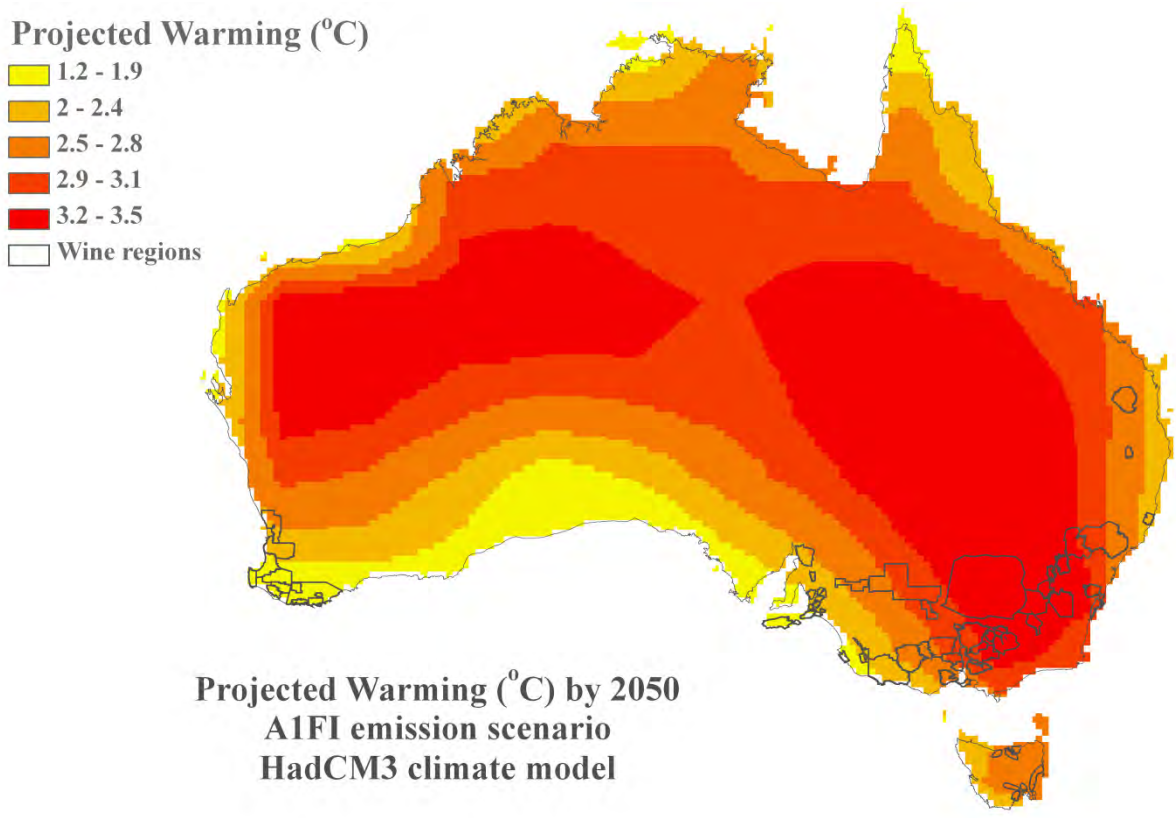


Table 1 – Range of projected change in growing season rainfall (Oct to Mar) from 3 climate models and 3 emission scenarios (17).

Region	Range of percent change to growing season rainfall (%) *	
	2030	2050
Clare Valley	-9.2 to -0.7	-21.3 to -1.3
Coonawarra	-9 to -1.4	-21.6 to -2.3
Riverina	-6.6 to 0	-16 to -0.2
Hunter Valley	-1.6 to 4.1	-2.6 to 9.9
Yarra Valley	-7.2 to -0.3	-17.4 to -0.6
Margaret River	-15 to -1.1	-36 to -2.2
Vic/NSW Murray Valley	-8.2 to -0.3	-19.9 to -0.5
Granite Belt	-3.4 to 3.3	-8.3 to 8.2
Tasmania	-5.6 to 0.8	-13.5 to 2.1

*Negative number indicates drier, positive number indicates wetter.

In most cases, models suggest that projected greenhouse gas induced temperature changes are likely to affect the grape and wine industries in the following ways (17):

- Earlier budburst;
- Decrease in season duration (i.e. length of growing season);
- Narrower harvest window (to determine optimum harvest time) and compression of the vintage period;
- Earlier harvest dates;
- Increase in harvest temperatures;
- Quality (modelled using grape price as a quality surrogate) reduced nationally by 7-23% (by 2030) and 12-57% (by 2050) with the range dependent on emission levels;
- Frost damage may be reduced due to higher temperatures, but earlier budburst date may result in frost risk remaining the same;
- In some regions (i.e. Margaret River) there may be inadequate winter chilling which may delay budburst and hence harvest dates;
- Yields may increase in warmer climates (as increased temperature is correlated with increased yields) - assuming adequate water supply;
- In hot regions (i.e. Riverina and Swan Valley) lower gross returns may occur as quality may be impacted too greatly for yield increases to compensate;
- Disease pressure may be reduced by less rainfall;
- In some regions projected increased summer rain may result in increased disease pressure; and
- Vineyard irrigation demand in the future will be higher.

These changes may impact on grape and/or wine quality in the following ways:

- In warmer than ideal environments, grape flavour compounds may develop more slowly than other compounds in the berry and while the winemaker waits for certain flavours to either appear or disappear, acidity is lost and sugar content increases. This can lead to high alcohol wines with low acidity;
- Higher temperatures during ripening can reduce the colour of red wine grapes and alter aroma profiles of both white and red grapes;
- Higher crushing temperatures increase the rate of oxidation if grape must is exposed to oxygen; and
- Yield can affect wine quality, so effects of elevated CO_2 and increased temperature on yield and its components will need to be closely monitored and, if necessary, managed.

Other direct implications on the grape industry include:

- Suitability of varieties for certain regions may change;
- Shifts in regional suitability may occur; and
- Water demand and availability may change.

Projected shifts in phenological timing could be positive or negative. Increases in temperatures in certain regions (i.e. the cooler climates of Tasmania and the Mornington Peninsula) may allow varieties that are currently considered marginal to be grown and ripened more fully.

MECHANISMS OF CLIMATE CHANGE

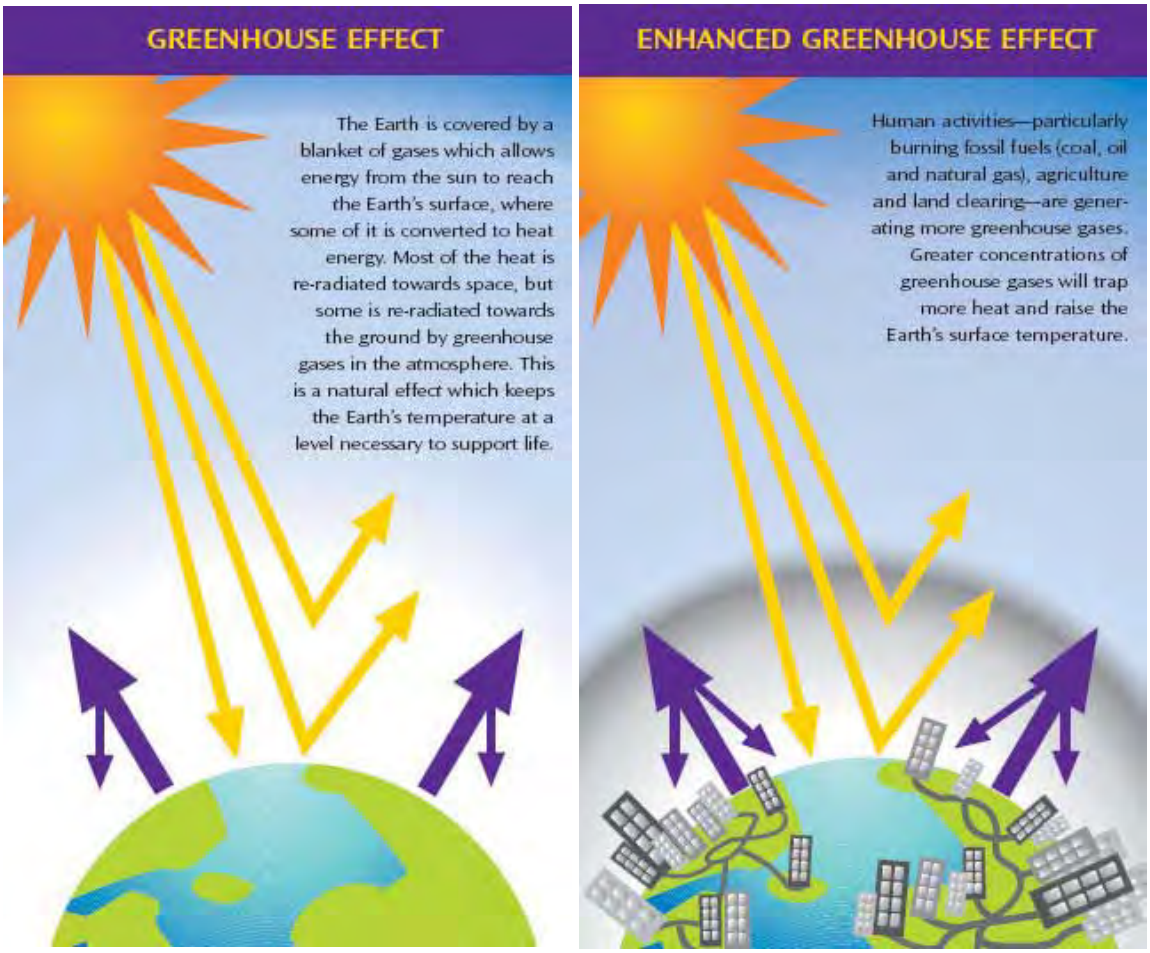
UNDERSTANDING OUR ATMOSPHERE AND THE GREENHOUSE EFFECT

The Earth is surrounded by an atmosphere of gases that allow the sun's visible radiation to reach its surface. Some of this radiation is converted to heat energy, of which most is re-radiated back to space. The remainder is re-radiated to the ground by greenhouse gases in the Earth's atmosphere.

The presence of greenhouse gases in the atmosphere (0.1% by volume) results in the maintenance of the Earth's surface average global temperature at 14°C, 33°C warmer than if there were no greenhouse gases at all (1). This process, which provides a moderate climate to which humans are presently adapted, is known as the greenhouse effect, as the Earth's atmosphere behaves like the roof of a greenhouse. The gases in the atmosphere that are responsible for re-radiating heat towards the Earth's surface are known as greenhouse gases.

Since the beginning of the Industrial Revolution, atmospheric carbon dioxide, methane and nitrous oxide levels have risen substantially to now exceed the natural range of the last two million years by 35%, 148% and 18%, respectively (1). As these gases play a role in the heating of the Earth's surface, the presence of higher concentrations of greenhouse gases in the Earth's atmosphere will raise Earth's surface temperature by trapping more heat.

Figure 8 – Schematic diagram of the greenhouse effect and the enhanced greenhouse effect (19)



Other influences on global surface temperature include:

- Particles and droplets in the air (i.e. aerosols) can reflect the incoming radiation so that it never reaches the surface;
- Aerosols can also cause changes in cloud cover (more clouds will reflect more sunlight from their upper surfaces, but also absorb more heat radiating from the earth);
- Aviation activities can influence cloud cover; and
- Variations in land cover (such as ice) affect the amount of sunlight that is reflected from the surface (the 'albedo' effect), and how much is absorbed and re-emitted as heat.

THE GREENHOUSE GASES AND WHERE THEY COME FROM

The main greenhouse gases arising from human activity, and those with the greatest influence on warming of Earth's atmosphere are:

- carbon dioxide;
- methane; and
- nitrous oxide.

Human activities result in the direct release of these greenhouse gases, but atmospheric concentrations of other gases that also re-radiate heat back to the surface, such as water vapour and ozone, are more difficult to control.

The synthetic (i.e. man-made) halocarbons, that also contribute to the total warming of the Earth's surface include:

- hydrofluorocarbons (HFC's);
- perfluorocarbons (PFC's);
- chlorofluorocarbons (CFCs); and
- sulfur hexafluoride.

CARBON DIOXIDE

Carbon dioxide is:

- the most abundant greenhouse gas after water vapour;
- very stable in the atmosphere;
- exchanged rapidly with plants and the ocean surface;
- redistributed through various forms of carbon storage, or 'sinks', as part of the carbon cycle; and
- rapidly increasing in concentration in the atmosphere (i.e. from about 280 ppm in 1750 to 383 ppm in 2007) (14).

Key natural sources of atmospheric carbon dioxide are:

- respiration from living organisms;
- volcanic eruptions;
- forest fires;
- decomposition of dead animals and plants; and
- outgassing from the ocean.

The dominant human activities leading to carbon dioxide emissions are:

- the combustion of fossil fuels;
- cement manufacture; and
- land-use changes, dominated by deforestation and changing agricultural practices.

METHANE

Methane is:

- a reactive compound of carbon and hydrogen;
- relatively short lived in the atmosphere, (reacts to form water vapour and carbon dioxide);
- naturally present in forests, oceans and termites (the largest source is natural wetlands);
- released from many sources including fossil fuel mining, vegetation burning, waste treatment, rice agriculture, ruminant livestock and landfill;
- stored in frozen soils and as methane hydrates in ocean sediments; and
- has increased from pre-industrial levels of approximately 715 parts per billion (ppb) to approximately 1774 ppb now (20).

NITROUS OXIDE

Nitrous oxide is:

- relatively stable in the atmosphere;
- eventually destroyed by reacting with ultraviolet light and charged oxygen molecules in the stratosphere;
- naturally formed by processes in soils and oceans, and from ammonia oxidation in the atmosphere;
- released by human activities such as fertiliser use, biomass burning, cattle production, fossil fuel combustion and industrial activities such as nylon manufacture; and
- present in the atmosphere at a concentration of approximately 319 ppb (an 18% increase from pre-industrial times) (1).

FLUORINATED GASES

Fluorinated gases are:

- man-made gases, and are generally non-flammable and non-toxic;
- used as replacements for ozone-depleting gases;
- used in refrigeration, air conditioning, solvents, fire retardants, foam manufacture and aerosol propellants (HFC's), as they have low boiling points;
- released in aluminium production (PFC's);
- used in the electricity supply industry in switches and high voltage systems (sulfur hexafluoride);
- removed from the atmosphere by oceanic surface water uptake and by degradation reactions with ultraviolet light, other agents in the atmosphere (i.e. chlorine), or by chemical and biological processes; and
- present in the atmosphere in relatively small concentrations but levels are increasing rapidly.

WATER VAPOUR

Water vapour is the most important and abundant greenhouse gas in the atmosphere. When skies are clear, it accounts for approximately 60% of the natural greenhouse effect (20).

The quantity of water vapour in the atmosphere is affected by temperature and therefore fluctuates over short and long time periods.

Water vapour is also produced in the stratosphere by methane oxidation, with the rate of reaction increasing as methane concentrations rise.

Further generation occurs directly from humans through irrigation and fossil fuel production (less than 1% of emissions from natural sources).

The water vapour concentration in the atmosphere, including cloud cover, is likely to be affected substantially by increases in global temperature as a result of climate change (1). This may further enhance the greenhouse effect, resulting in a feedback loop.

DIRECT SOURCES OF EMISSIONS IN THE WINE INDUSTRY

Six greenhouse gases are covered in the Kyoto Protocol; carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride. The main areas where these gases are produced and/or released in the wine industry are listed in Table 2.

Table 2 – Sources of direct greenhouse gas emissions in the wine industry

Greenhouse Gas	Chemical Abbreviation	Sources of generation in the Wine Industry
Carbon Dioxide	CO_2	Combustion of fuel and supply of electricity
Methane	CH_4	Waste treatment
Nitrous Oxide	N_2O	Fertilizer application and soil cultivation
Hydrofluorocarbons	HFCs	Refrigerant leakage
Sulfur Hexafluoride	SF_6	Insulated switchgear

How is the warming from different gases compared?

As the nature and properties of individual greenhouse gases are different, their abilities to absorb heat as well as their lifetime in the atmosphere vary greatly (14). In order to compare the effect of different greenhouse gases a global warming potential (GWP) index has been developed. This index compares the effect of a given mass of a greenhouse gas to the effect of the same mass of carbon dioxide and takes into account the capability of a molecule to absorb heat and the lifetime of gas in the atmosphere.

The magnitude of the GWP values will vary depending on the time period used in the calculation. The impacts of emissions and reductions of the various greenhouse gases can be compared by utilization of the GWP values.

Reporting regulations in Australia use the following GWP's (37):

- 1 for carbon dioxide (by definition);
- 21 for methane; and
- 310 for nitrous oxide.

GWP's are also used to convert emissions to an equivalent amount of carbon dioxide, usually expressed as "CO_2-e"

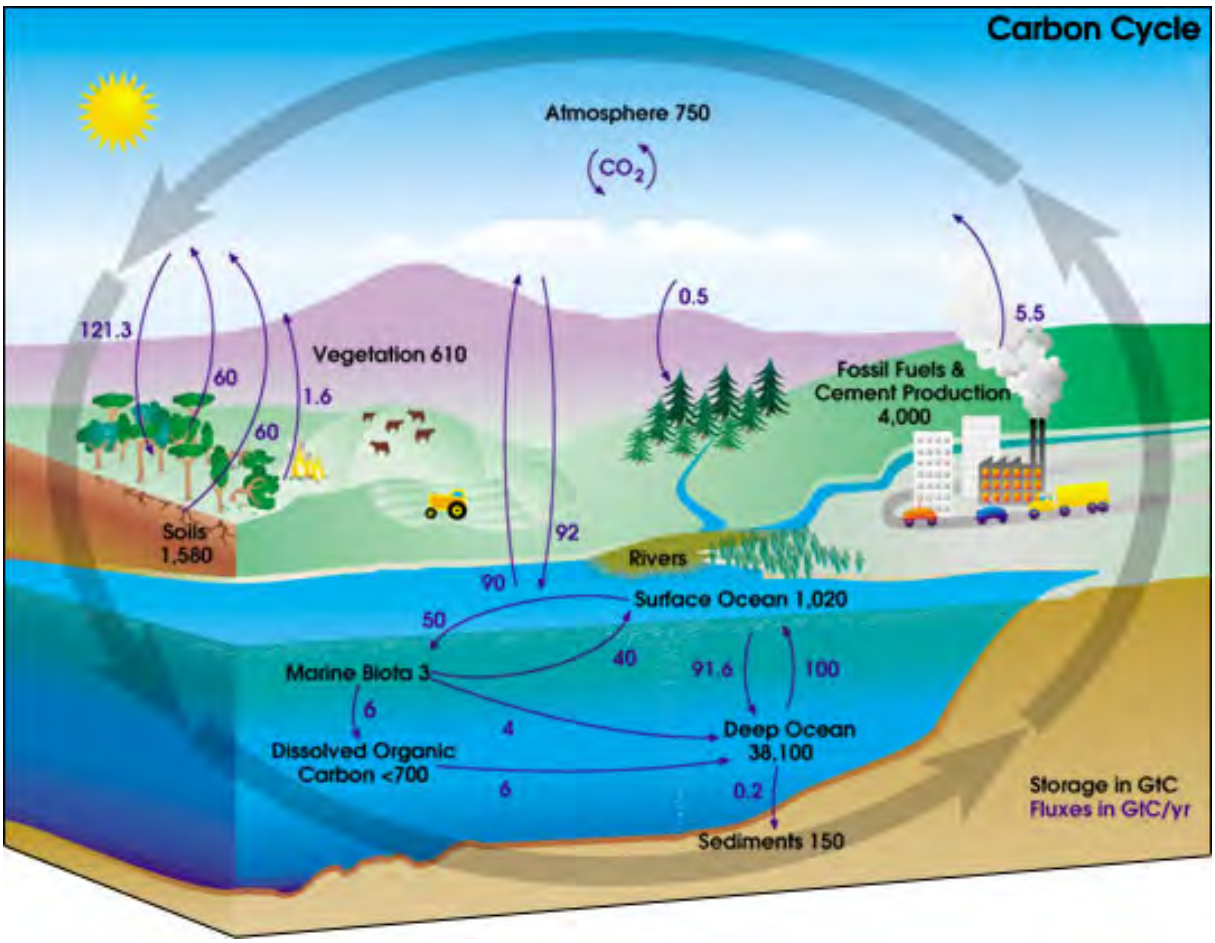
THE CARBON CYCLE

The carbon cycle is the natural cycle by which carbon is exchanged between the different systems that operate on Earth. There are four major storages of carbon, which are interconnected by processes of exchange. The storages are:

- The atmosphere;
- The terrestrial biosphere, which is usually defined to include fresh water systems and non-living organic material, such as soil carbon;
- Oceans, including dissolved inorganic carbon and marine biota; and
- Sediments including fossil fuels.

Figure 9 shows the full carbon cycle, including both the long-term and short-term. The black number represent approximate total storage capacities in billions of tonnes (in 2004), and the purple numbers are annual rates of exchange in billions of tonnes.

Figure 9 – The Carbon Cycle (21)



UNDERSTANDING THE SHORT-TERM CARBON CYCLE

Common carbon accounting methods exclude the short-term carbon cycle. For this reason it is important to understand what contributes to the short-term carbon cycle and what is classified as part of the long-term carbon cycle.

The short-term cycle includes the rapid exchange of carbon between plants and animals through respiration and photosynthesis, and through gas exchange between the oceans and the atmosphere. The short-term carbon cycle extends into the wine industry to include fermentation, emissions of CO_2 from wastewater and landfill and sequestration into non-permanent structures and sources within the vineyard. Emissions of CO_2 that arise directly from the combustion or degradation of biomass are treated as part of the short-term carbon cycle. This includes burning wood and other biomass as a fuel.

The following emission sources and sinks are excluded from reporting as they are part of the short-term carbon cycle.

- Fermentation;
- Non-permanent vineyard growth;
- Grape growth;
- CO_2 emissions from aerobic waste treatment both solid and liquid; and
- CO_2 emissions from the combustion of biomass fuels.

Emissions of other greenhouse gases from the combustion of biomass are not part of the short-term carbon cycle and are included in carbon accounting.

Methane (CH_4) and nitrous oxide (N_2O) emissions from vineyards, wastewater, solid waste and the combustion of biomass fuels are not part of the short-term carbon cycle and must be counted.

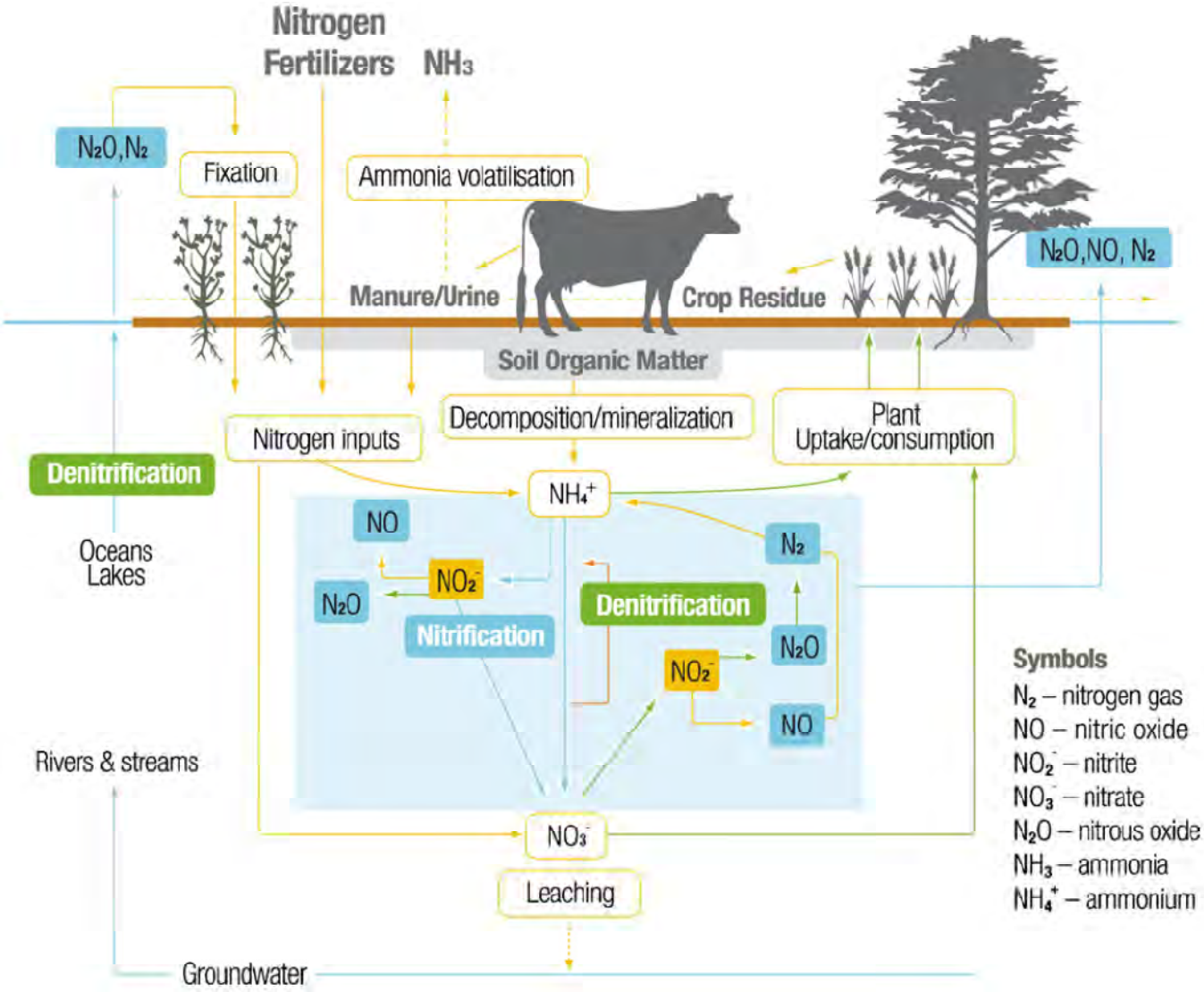
THE NITROGEN CYCLE

The nitrogen cycle refers to natural processes involving the transformations of nitrogen and nitrogen-containing compounds (22).

Nitrous oxide can be formed by a number of processes in agricultural soils, and is determined by soil properties and external conditions such as moisture content, oxygen availability, amount and form of nitrogen, tillage practices etc. (23). One pathway is the oxidation of ammonia to nitrite via ammonium under conditions of limited oxygen availability, typically when soil water content lies between 55 and 65% water-filled pore space. Another, possibly more common, pathway is dissimilatory nitrate reduction, where nitrite or nitrate is reduced to gaseous dinitrogen or ammonium , with nitric oxide and nitrous oxide as intermediates. Nitrous oxide production from this process highest at around 60-75% water-filled pore space.

As well as being a powerful greenhouse gas, nitrous oxide can also break down and act as a catalyst in the destruction of atmospheric ozone.

Figure 10 – Nitrogen cycling in soils (microbial processes are shaded). Nitrification and denitrification processes are dependent on the availability of nitrogen substrate, soil organic matter and oxygen, and the proportion of nitrous oxide produced depends on the extent of oxygen limitation. Non-bacterial nitrogen losses occur via leaching, ammonia volatilisation, and surface run-off (23)



Online reference material for module 1

National Snow and Ice Data Centre http://nsidc.org/

Bureau of Meteorology - Climate http://www.bom.gov.au/climate/

Great Barrier Reef Marine Park Authority http://www.gbrmpa.gov.au/corp_site/key_issues/climate_change

CSIRO - Climate Change http://www.csiro.gov.au/science/ClimateChange.html

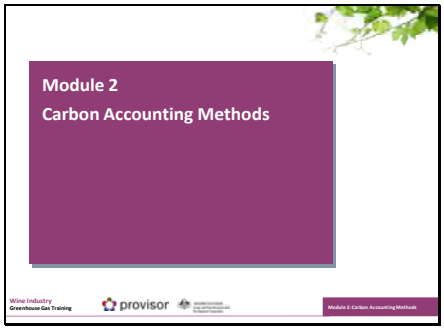
Garnaut Climate Change Review http://www.garnautreview.org.au

United Nations Framework Convention on Climate Change http://unfccc.int

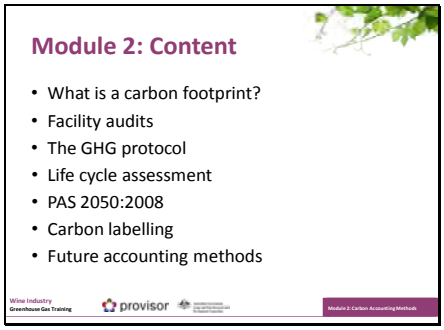
Module 2

Carbon Accounting Methods

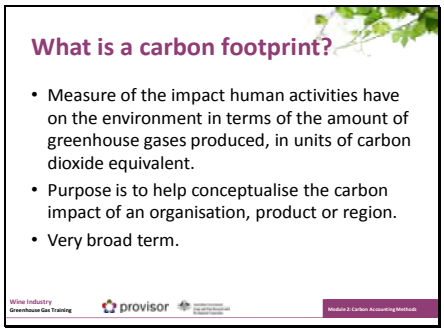
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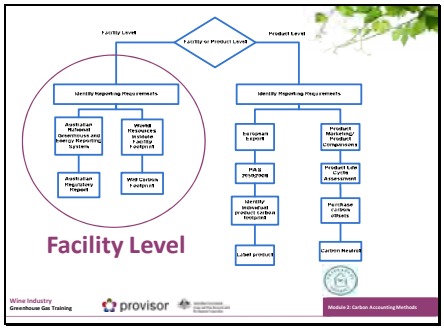
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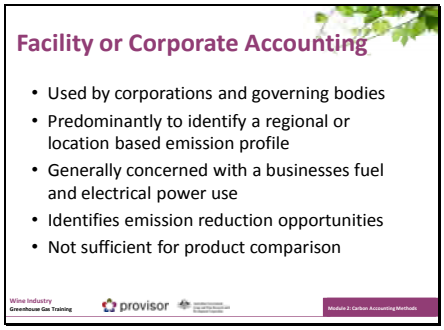
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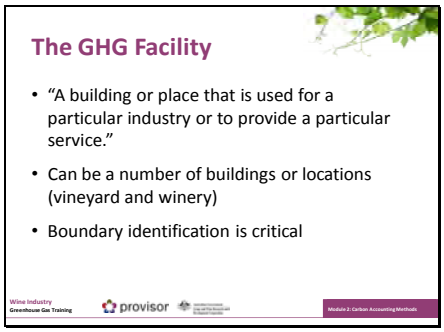
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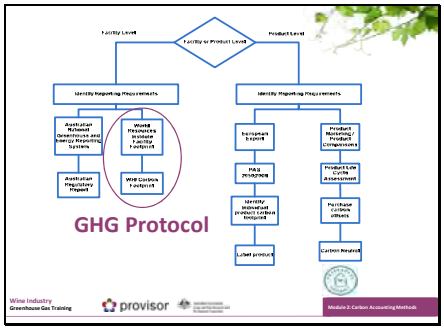
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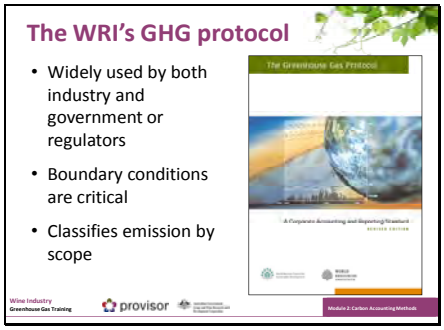
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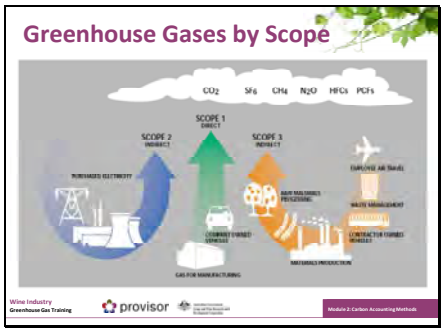
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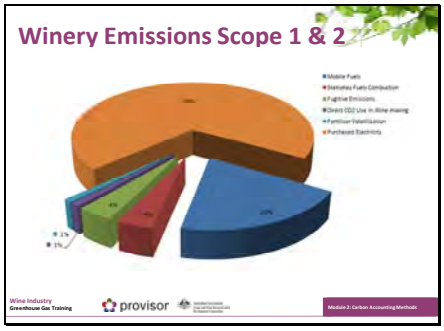
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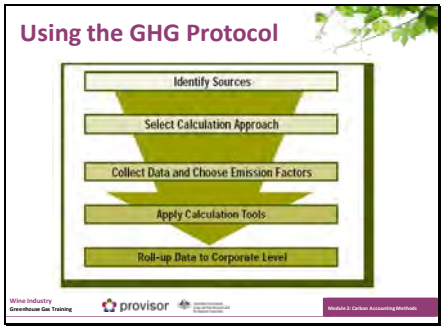
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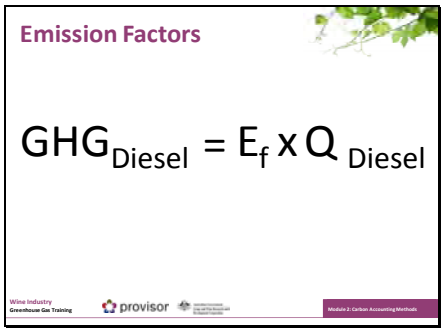
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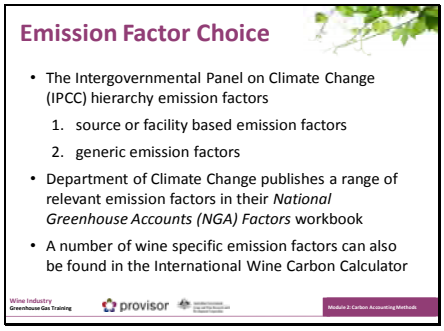
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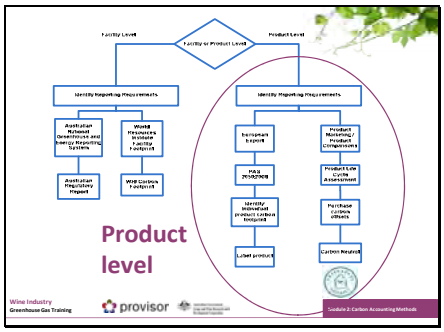
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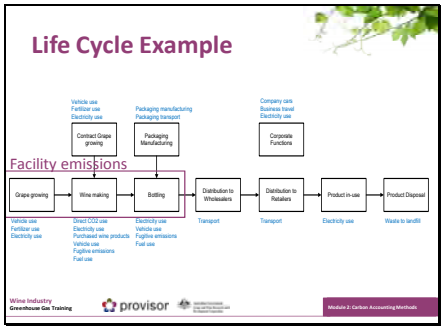
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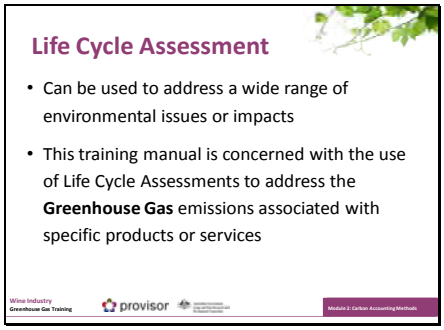
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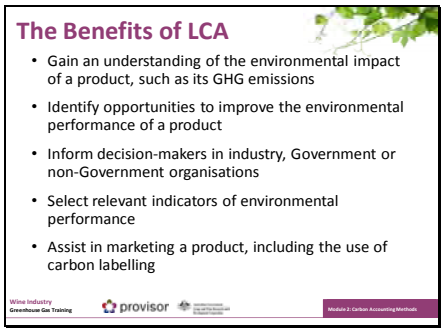
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LCA stages or phases

1. Goal and scope definition phase
2. Inventory analysis phase
3. Impact assessment phase
4. Interpretation phase

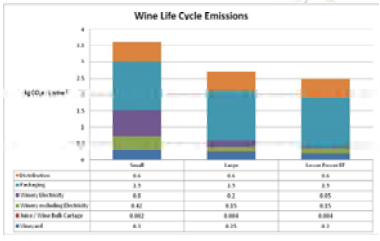
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GHG Life Cycle Assessment

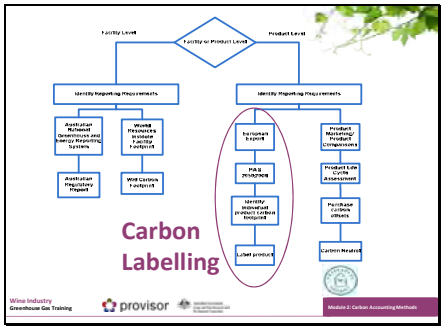
- Outside of the scope of the IWCC
- Can be a valuable exercise for a company to complete
- Big commitment – 4 to 6 weeks for experienced consultants to complete
- Generally done on products

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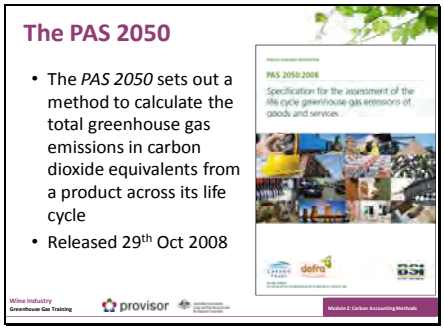
Life Cycle Emissions



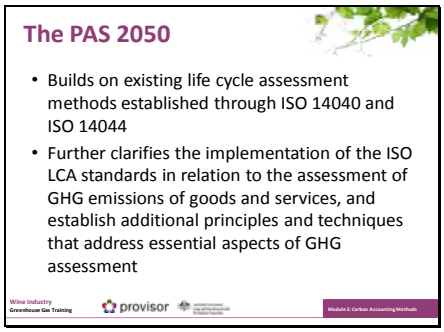
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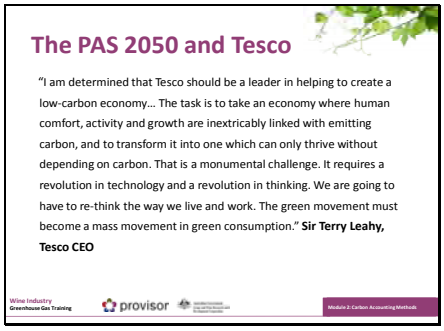
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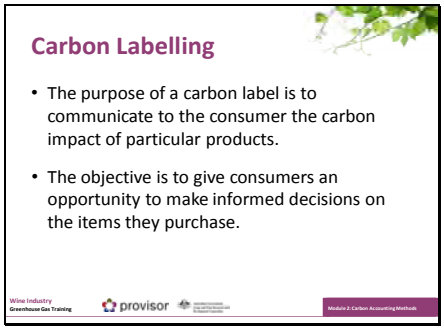
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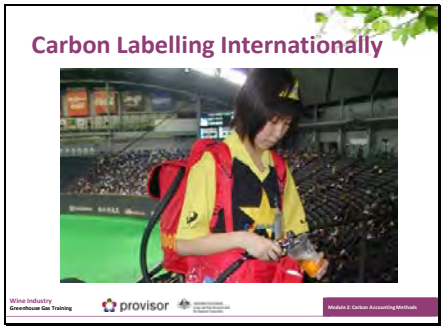


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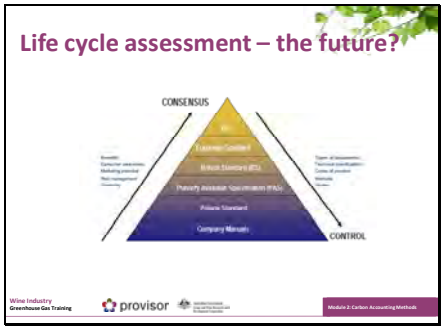


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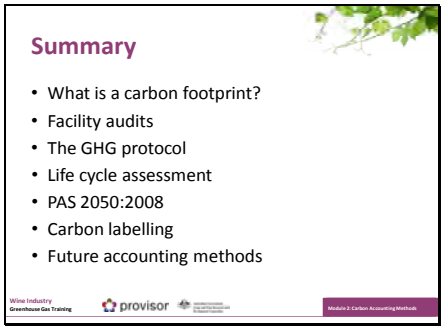
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WHAT IS A CARBON FOOTPRINT?

A carbon footprint is a "measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide" (24). It is meant to help individuals and organizations to conceptualize their contribution to human induced climate change.

There are two predominant methods used in quantifying carbon emissions. The first methodology is based on the World Resources Institute's (WRI) guidelines on carbon accounting and considers the direct emissions at an enterprise or facility level. This method is often used for corporate and Government reporting purposes.

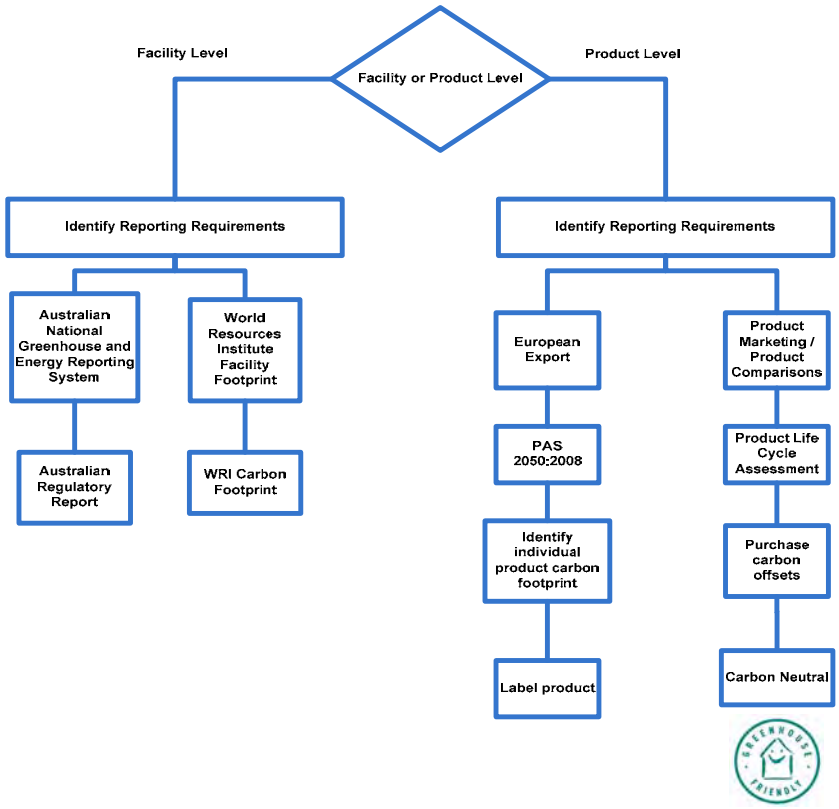
The other main form of accounting considers the carbon embedded in a particular product, such as a jar of jam or a bottle of wine. This method accounts for all of the greenhouse gas emissions involved in producing a product, packaging it and delivering it to the point of sale. Life cycle assessments are used to quantify emissions associated with a particular product.

Which method is suitable for you? This will depend upon your carbon accounting requirements. If you are reporting your carbon emissions to the Government, then following the facility approach will be sufficient. If you wish to market your product as having low carbon emissions, then you will need to consider the entire supply chain of your product and will need a life cycle assessment, validated externally, to back up the low carbon emission claims.

Increasingly, retailers are investing in the development of carbon labelling programs for food and grocery items in the UK, France and recently Japan.

The following decision tree helps to determine which approach should be followed.

Figure 11 –Comparison of different carbon accounting methods



About the GHG Protocol

A decade-long partnership between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), the GHG Protocol is working with businesses, Governments, and environmental groups around the world to build a new generation of credible and effective programs for tackling climate change (44).

FACILITY AUDITS AND EMISSIONS PROFILES

UNDERSTANDING FACILITY EMISSIONS

A facility is defined as a building or place that is used for a particular industry or to provide a particular service. In the context of greenhouse gas accounting, examples might include a vineyard, winery, packaging centre or any combination of these items. A facility is generally defined by a singular physical location but could be made up of a number of physical locations closely associated; an example could be a winery and vineyard where the winery is contained within the vineyard surrounds. Facility emissions refer to emissions generated at that facility, or in the production of energy consumed at the facility, and does not include the remainder of the supply chain.

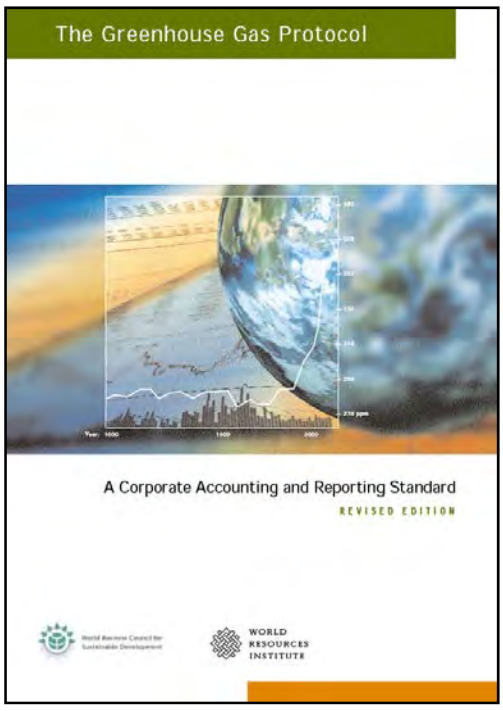
WHAT IS THE GREENHOUSE GAS PROTOCOL?

The WRI's Greenhouse Gas Protocol (GHG Protocol) is a widely used accounting tool for Governments and businesses to understand, quantify, and manage greenhouse gas emissions.

The GHG Protocol provides standards and guidance for companies preparing a greenhouse gas emissions inventory. It covers the six greenhouse gases within the Kyoto Protocol.

The standard was designed to help companies calculate their greenhouse gas emissions fairly and consistently, through the use of a universally agreed approach.

When adopting the WRI approach to greenhouse gas accounting, it is important to set the organisational and operational boundaries appropriately, as these will determine what emissions are included within your organisations emission profile. Businesses vary in organisational structures and similar operations may have very different financial or accounting practices. When setting organisational boundaries, a company selects an approach for consolidating greenhouse gas emissions and then consistently applies the selected approach to define those businesses and operations that constitute the company for the purpose of accounting and reporting greenhouse gas emissions. (25)



When establishing organisational boundaries, two approaches can be used; the equity share approach or the control approach. Under the equity share approach, a company accounts for greenhouse gas emissions from operations according to its share of equity in the operation. The equity share reflects economic interest, which is the extent of rights a company has to the risks and rewards flowing from an operation. Under the control approach, a company accounts for 100 percent of the greenhouse gas emissions from operations over which it has control. It does not account for greenhouse gas emissions from operations in which it owns an interest but has no control. Control can be defined in either financial or operational terms. (25)

The GHG Protocol's main feature is the use of three 'Scopes' used to help delineate greenhouse gas emissions for accounting purposes. The GHG Protocol clearly defines the Scope's as follows:

Scope 1: Direct greenhouse gas emissions

Emissions that occur from sources directly controlled by the company, for example, emissions from forklifts, tractors and boilers.

Scope 2: Electricity Indirect greenhouse gas emissions

Scope 2 is reserved for emissions from the generation of purchased electricity. Scope 2 emissions physically occur at the generation site, however these emissions must be included within the greenhouse gas inventory of the company that uses this electricity.

Direct GHG emissions are principally the result of:

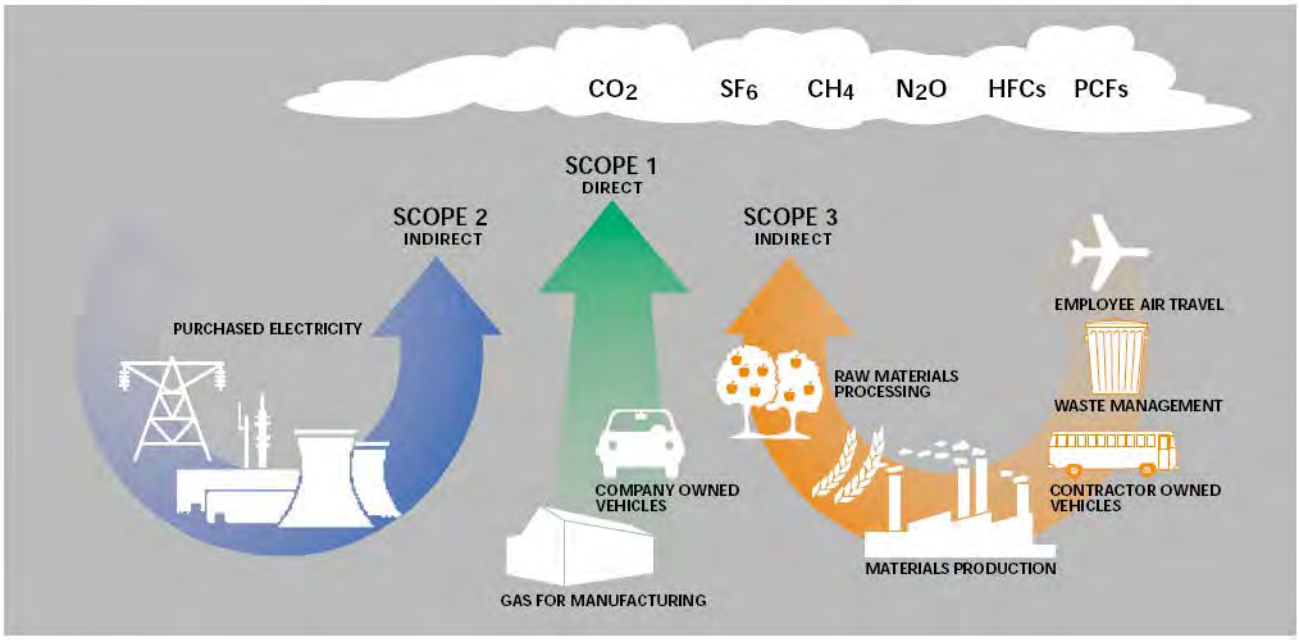
- The combustion of fuels in stationary sources, for example, barrel hall heaters and winery boilers;
- Physical or chemical processing. For example, when producing glass, the raw materials react and generate CO_2;
- Transportation of materials, products, waste, and employees. These emissions result from the combustion of fuels in mobile combustion sources (e.g., trucks, trains, ships, airplanes, buses, and cars); and
- Fugitive emissions. These emissions result from intentional or unintentional releases of greenhouse gases. Typical examples include refrigerant emissions and methane leakage from land fill.

Scope 3: Other (indirect) greenhouse gas emissions

Scope 3 emissions occur from sources not owned or controlled by the company but are necessary to produce and sell that company's product or service.

When reporting under the WRI guidelines companies must, as a minimum, report their Scope 1 and 2 emissions. The reporting of Scope 3 items is optional.

Figure 12 – Overview of the concept of Scope in greenhouse gas emissions (26)



The GHG Protocol lists its objectives as:

- To help companies prepare a GHG inventory that represents a true and fair account of their emissions, through the use of standardised approaches and principles;
- To simplify and reduce the costs of compiling a GHG inventory;
- To provide business with information that can be used to build an effective strategy to manage and reduce GHG emissions;
- To provide information that facilitates participation in voluntary and mandatory GHG programs; and
- To increase consistency and transparency in GHG accounting.

THE GHG PROTOCOL APPROACH

The GHG Protocol recommends the following approach to conducting a greenhouse gas accounting project.

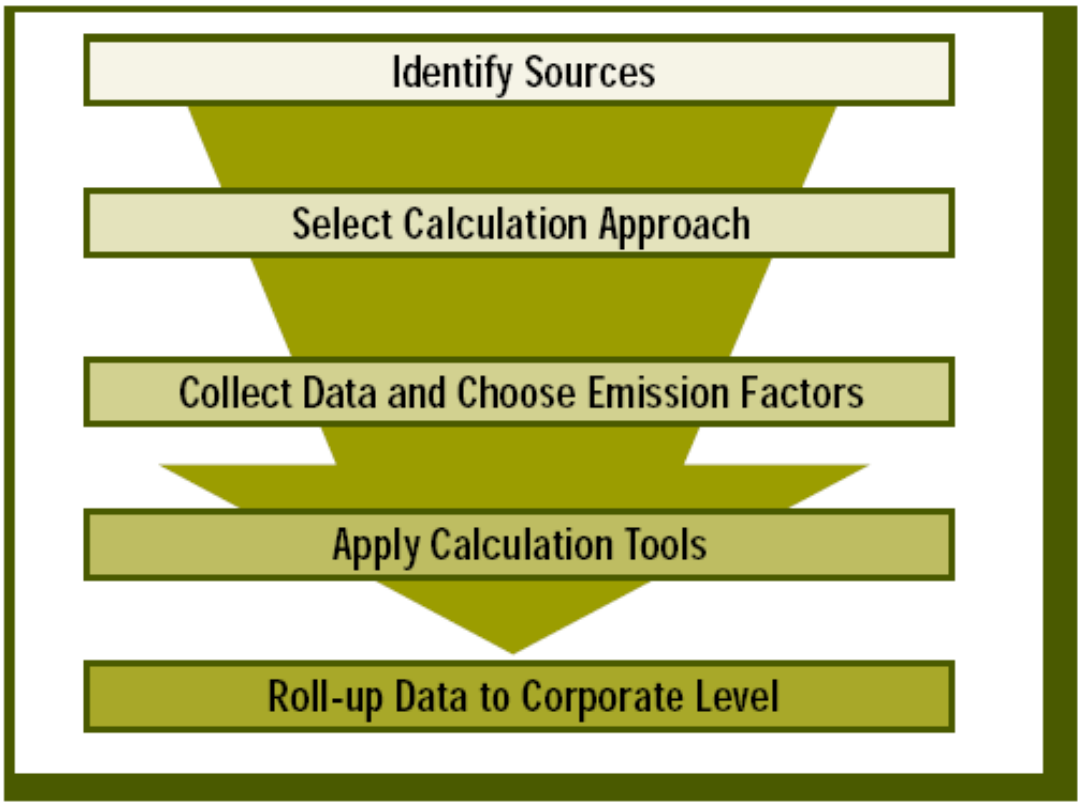
IDENTIFY SOURCES

Every business sector has different greenhouse gas sources. As a first step it is recommended that companies identify their direct emission sources. This can be done effectively by producing a process flow map and listing all activities on the flow map.

CALCULATION APPROACH

There are a number of ways to calculate greenhouse gas emissions. Direct measurement is not commonly used, as the measurement equipment is expensive and difficult to use. Mass and stoichiometric calculations are used in some chemical processing environments. However, the most common method is to apply documented emission factors to input data such as fuel and electricity.

Figure 13 – Steps in identifying and calculating greenhouse gas emissions under the GHG Protocol (25)



EMISSION FACTOR CHOICE

The Intergovernmental Panel on Climate Change (IPCC) guidelines refer to a hierarchy of calculation approaches and appropriate emission factors. General guidance suggests that if source or facility based emission factors are available these should be used in preference to more generic emission factors.

Within Australia, the Department of Climate Change publishes a range of relevant emission factors in their *National Greenhouse Accounts (NGA) Factors* workbook (27). A number of wine specific emission factors can also be found in the International Wine Carbon Calculator (28).

APPLY CALCULATION TOOL

There are a number of calculation tools available for users to convert their collected data into an emission value. The WRI have both sector specific and cross sector models available from their website (http://www.ghgprotocol.org). The FIVS have also endorsed a wine specific greenhouse gas calculator, called the International Wine Carbon Calculator (IWCC).

ISO 14064

After the wide adoption of the GHG Protocol following its initial publication in 2004, the International Standards Organisation built on the method and formalised it in ISO 14064, released in 2006.

For corporate greenhouse gas emissions accounting, the two standards are consistent and can be used together in a complimentary manner. In December 2007, the three organisations behind the development of the standards announced their co-operation on promoting the standards. (29)

11 August 2008
Media Release – IWCC Version 1.2 (48)

An updated and refined **Version 1.2 of the International Wine Carbon Protocol and calculator** was released on 25 July 2008 and is now available for download free of charge from the Winemakers' Federation of Australia website. The carbon footprint calculator project was originally developed by a partnership between the wine industries of Australia, California, New Zealand and South Africa and has received international attention. The Protocol and calculator was formally endorsed by FIVS, an association representing alcohol beverage interests, in March 2008. Amy Russell, FIVS sustainability spokesperson, commented, "the FIVS endorsement is a key achievement. The protocol and calculator have gained recognition as a truly international carbon initiative, with relevance beyond the original four wine producing countries that collaboratively developed the project."

LIFE CYCLE APPROACH

INTRODUCTION TO LIFE CYCLE ASSESSMENT

Companies making environmental claims about their products and services have come under intense scrutiny in recent years. This has driven the need for a technique to accurately assess the true environmental performance of a product, service or company. The most appropriate method should consider the entire 'life' of a product or service including all environmental impacts from the manufacture, use and disposal of the product. This type of method is commonly referred to as a life cycle assessment (LCA).

LCA is an analysis tool to identify the environmental impact of a product (or service) over all stages of the product's life. This includes raw material production or extraction, manufacturing, distribution, use, consumption and disposal. A range of environmental impacts can be accessed via the use of an LCA.

A life cycle assessment is typically used to (30):

- Gain an understanding of the environmental impact of a product, such as its greenhouse gas emissions;
- Identify opportunities to improve the environmental performance of a product;
- Inform decision-makers in industry, government or non-government organisations;
- Select relevant indicators of environmental performance; and
- Assist in marketing a product, including the use of carbon labelling.

A life cycle assessment can be used to address a wide range of environmental issues or impacts; this training manual is relevant to the use of life cycle assessments to address the greenhouse gas emissions associated with specific products or services only. There are four recognised stages associated with life cycle assessments:

1. The goal and scope definition phase;
2. The inventory analysis phase;
3. The impact assessment phase; and
4. The interpretation phase.

The scope, including system boundary and level of detail, depends on the subject and the intended use of the study. The depth and the breadth of LCA can differ considerably depending on the goal of a particular LCA.

Life Cycle Assessment: "Consecutive and interlinked stages of a product system, from raw material acquisition to final disposal… Compilation and evaluation of the inputs and outputs and the potential environmental impacts of a product system throughout its life cycle"

ISO 14040

DIFFERENCES BETWEEN FACILITY AND LIFE CYCLE APPROACHES

A life cycle assessment is different from a facility footprint, mainly because when considering the life cycle emissions of a product, supply chain emissions are also included.

The following table, although far from a complete emissions inventory, compares the difference in approach between a facility footprint assessment and a life cycle assessment for the production of glass bottles.

Table 3 – Comparison of inclusion of emission sources for a facility audit and LCA of glass bottle manufacturing

Emission Source	Facility audit	Life cycle assessment
Fuel consumed at glass works	☑	☑
Electricity consumed at glass works	☑	☑
Refrigerant emissions from glass works	☑	☑
Waste related emissions	☑	☑
Soda ash production	☒	☑
Sand mining	☒	☑
Feldspar preparation	☒	☑
Raw material transport to glass works	☒	☑
Finished product transport	☒	☑
Product in use emissions	☒	☑
Product disposal	☒	☑
Staff business travel	☒	☑

Quantifying the emissions associated with a facility is a useful environmental indicator and is a logical first step for most companies embarking on a greenhouse gas reduction campaign for the first time. However, the information that it presents is not as complete as that provided from a life cycle assessment.

When the intention of the study is to present information to the public, a life cycle assessment must be used when making claims, especially if the claims are used to compare two products or if the claim relates to carbon neutrality (31).

Claims should consider the whole product life cycle:

When making claims about a particular characteristic or part of a product, you should also consider the whole product life cycle. The manufacturing, recycling, destruction and disposal process should be taken into account before making any environmental claims regarding the relevant characteristic or part (31).

For example, consider a car that is manufactured to be extremely fuel efficient and advertised as ‘green’ or ‘eco-friendly’ This does not take into account the environmental impact of the production process or the disposal of the car at the end of its life cycle, which may have a large environmental impact. Advertising the car as being ‘fuel efficient’ rather than ‘green’ could help avoid misleading consumers.

THE PUBLICLY AVAILABLE SPECIFICATION 2050

The *PAS 2050 - Specification for the assessment of the life cycle greenhouse gas emissions of goods and services* (PAS 2050), sets out a method to calculate the total greenhouse gas emissions in carbon dioxide equivalents from a product across its life cycle (32).

The PAS 2050 is a British specification, not a British or International standard. The significance to the wine industry is the potential application of PAS 2050 as the basis for UK retailer carbon labelling schemes. The PAS 2050 is also being used as a reference document in the development of other business, national and international carbon footprint standards around the world.

Development of PAS 2050 started in June 2007 with the Carbon Trust, the UK's Department for Environment, Food and Rural Affairs (DEFRA), and British Standards Institute (BSI) forming the development team. The project involved two major stages of industry consultation, ensuring a wide variety of concerns were taken into account. Expert advice from work groups and support via commissioned research was also included within the development.

The final version of the standard was released on 29 October 2008, and is accompanied by a detailed guide on how to implement the standard (33).

THE AIM OF THE PAS 2050

The PAS 2050 method provides guidance to British companies, and companies supplying the British market, to measure the life cycle greenhouse gas emissions of their goods and services. This will enable a foundation for comparisons between products based on their contribution to climate change. The PAS 2050 also aims to provide a methodology to analyse the improvements in carbon performance for products and services.

THE MEASUREMENT METHOD

The PAS 2050 method applies to all goods and services. Within the PAS 2050, there is some opportunity to customise the method to different types of goods and services. It sets out to consider all life cycle emissions within the entire supply chain of a good or service. It can be applied to both business-to-consumer products, quantifying emissions from 'cradle to grave', and to business-to-business products, quantifying emissions from 'cradle to gate', where they form part of the life cycle another product.

What is a Publicly Available Specification?

PAS's are developed using a similar process to that of British Standards and are commissioned by an external sponsor, subject to stakeholders consultation, but do not require full consensus. These differences between a PAS and formal consensus British Standards enable PAS's to be developed and published faster in order to satisfy short term business needs particularly in areas of technology, innovation or service industries. Some PASs may evolve into formal consensus standards.

PAS 2050 builds on existing life cycle assessment methods established through ISO 14040 and ISO 14044 by specifying requirements for the assessment of the life cycle greenhouse gas emissions of goods and services (32). These requirements further clarify the implementation of the above standards in relation to the assessment of greenhouse gas emissions of goods and services, and establish additional principles and techniques that address essential aspects of greenhouse gas assessment, including:

- scope of greenhouse gases to be included;
- criteria for global warming potential data;
- treatment of emissions from land use change, and biogenic and fossil carbon sources;
- treatment of the impact of carbon storage in products, and offsetting;
- requirements for the treatment of greenhouse gas emissions arising from specific processes;
- data requirements and accounting for emissions from renewable energy generation; and
- claims of conformity.

CARBON LABELLING

Recent research suggests that two thirds of UK consumers want to know the carbon footprint of the products they use (31). The Carbon Label Company, a commercial subsidiary of the UK's Carbon Trust, is developing a carbon label suitable for use on goods and services. The label indicates the total carbon emissions associated with a product's life cycle. As part of their trial of the PAS 2050, the retailer Tesco has used carbon labels on a number of own-brand products.

Several retailers around the world, including Australia, are currently reviewing carbon footprint methods with a view to including them in supplier guidelines. This may include the use of carbon labels, or the establishment of minimum standards for emissions performance. It is important for Australian wine producers to be aware of these developments should they become market requirements in the future.

The purpose of a carbon label is to communicate to the consumer the carbon impact of particular products. The objective is to give consumers an opportunity to make informed decisions on the items they purchase. The carbon label can also help to highlight the amount of emissions arising from the consumer's use of the product, and what role the consumer can play in reducing the overall life cycle emissions. Ultimately consumers may use carbon ratings as a factor in their purchasing decisions.

In addition to its role in the development of the PAS 2050, the Carbon Trust has also produced the *Code of Good Practice for Product Greenhouse Gas (GHG) Emissions and Reduction Claims* (34). This document supports the communication and reduction of product life cycle greenhouse gas emissions. To achieve this, claims made under this Code must be accurate, verifiable, relevant and not be misleading. The Code provides a robust structure for reporting the life cycle GHG emissions of products, or a reduction in these emissions, to internal or external stakeholders. This is achieved by helping organisations to communicate their products' life cycle GHG emissions and/or emission reductions, assessed in conformity with PAS 2050, in a robust and clear manner, and on a consistent basis.



In January 07, Sir Terry Leahy, Tesco CEO, said: "I am determined that Tesco should be a leader in helping to create a low-carbon economy… The task is to take an economy where human comfort, activity and growth are inextricably linked with emitting carbon, and to transform it into one which can only thrive without depending on carbon. That is a monumental challenge. It requires a revolution in technology and a revolution in thinking. We are going to have to re-think the way we live and work. The green movement must become a mass movement in green consumption."

Sir Terry also announced Tesco's carbon labelling initiative: "We will begin the search for a universally accepted and commonly understood measure of the carbon footprint of every product we sell – looking at its complete lifecycle from production, through distribution to consumption. It will enable us to label our products so that customers can compare their carbon footprint as easily as they can currently compare their price or their nutritional profile. Armed with this information the customer is really in charge. And we can help our customers in so many ways, making it easy for them to measure and reduce their carbon footprint in real time – day-by-day and week-by-week" (45)

CASE STUDY – WALKERS CRISPS

Walkers, in conjunction with the Carbon Trust calculated the carbon emissions associated with a standard packet of Cheese & Onion Crisps. They calculated the emissions by first producing a map of their supply chain and identifying where the emissions were occurring. Secondly they converted the raw data from the different emission sources into a carbon value, and lastly they summarised these emissions (35).

The emissions were calculated from five different stages:

1. Raw materials: Potatoes, sunflowers and seasoning
2. Manufacture: Producing crisps from potatoes
3. Packaging the crisps
4. Distribution: Transportation of ingredients and the product
5. Disposal of the empty packs

The final calculations resulted in Walkers identifying that their Cheese and Onion Crisps, when packaged in the standard 35 gram bag contributed 75 grams of carbon emissions throughout its supply chain. This figure was calculated using an early draft of the PAS 2050 and will now need to be revised in line with the final PAS 2050.

Walkers will also need to continue to update and refine this number whenever their process changes.



Walkers



Walkers

THE FUTURE OF LIFE CYCLE ASSESSMENTS

THE GHG PROTOCOL LIFE CYCLE PROGRAM

In November 2007, the WRI/WBCSD team, that developed the GHG Protocol, began to investigate if there was a need to develop guidelines relating to supply chain greenhouse gas emissions. The investigation considered products, businesses and services. A survey was sent to a number of key stakeholders, including the Winemakers' Federation of Australia, with the intention of gauging how important stakeholders thought it was to include the supply chain when estimating emissions (36).

The results from the survey showed an urgent need for the development of an international supply chain Greenhouse Gas Protocol. Although the survey clearly identified the need for such a Protocol, the format, content and proposed scope varied significantly amongst the survey recipients.

Four options were presented:

- Product-level life cycle accounting;
- Corporate-level life cycle accounting;
- Product-level supply chain accounting; and
- Corporate-level supply chain accounting.

Two options gained traction with the respondents; product life cycle accounting and corporate supply chain accounting.

Following the results of the survey, an expert and stakeholder consultation process was conducted. From this process approximately seventy different sources of information were established as providing useful guidance in the area of supply chain emissions, including the ISO life cycle assessment standard and the PAS 2050.

To develop the new guidelines, the GHG Protocol is following the same broad, multi-stakeholder process used to develop the previous standards, with participation from businesses, policymakers, non-government organisations, academics and other experts and stakeholders from around the world.

The work on the WRI supply chain standard is still in its infancy. There are numerous steering committee, technical group and advisory group meetings planned before the final acceptance of the new protocol, due in May 2010.

Online reference material for module 2

The Carbon Trust http://www.carbontrust.co.uk

The Carbon Trust's Carbon Reduction Label http://www.carbon-label.com/

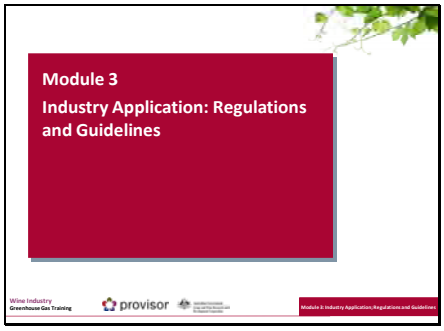
The Greenhouse Gas Protocol http://www.ghgprotocol.org/

BSI PAS 2050 http://www.bsigroup.com/en/Standards-and-Publications/Industry-Sectors/Energy/PAS-2050/

Module 3

Industry Application: Regulations and Guidelines

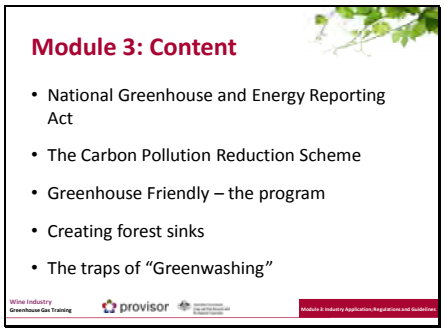
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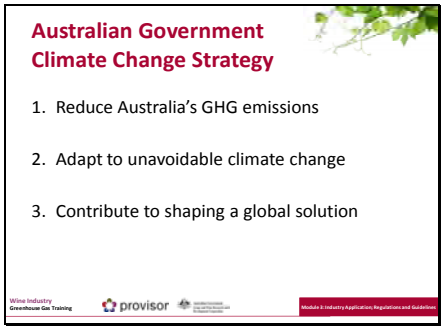
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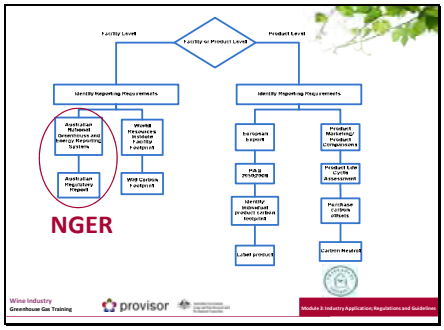
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Slide 4



Slide 5



Slide 6



Slide 7

National Greenhouse and Energy Reporting Act

	2008 -2009 Reporting year 1	2009 -2010 Reporting year 2	2010 - onwards Reporting year 3 onwards
Facility thresholds	25 kt CO_2-e 100 TJ		
Corporate group thresholds	125 kt CO_2-e 500 TJ energy	87.5 kt CO_2-e 350 TJ energy	50 kt CO_2-e 200 TJ energy
Corporations to apply for registration by	31 August 2009	31 August 2010	31 August 2011
Corporations to report by	31 October 2009	31 October 2010	31 October 2011
Government to publish data by	28 February 2010	28 February 2011	28 February 2012

Slide 8

National Greenhouse and Energy Reporting Act

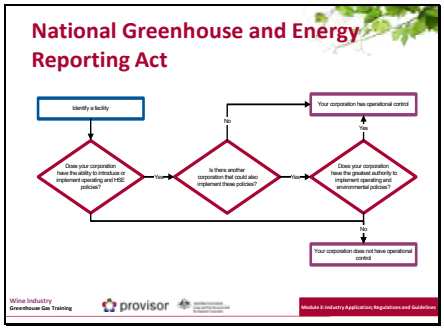
- The definition of a 'single site' under the NGER act is *"a single physical area that can include a series of geographical locations in close proximity to one another"*
- Applied to the wine industry, this means that company owned vineyards near the winery could be considered a single site
- It is recommended that further advice be sought on this issue from the Department of Climate Change, if relevant

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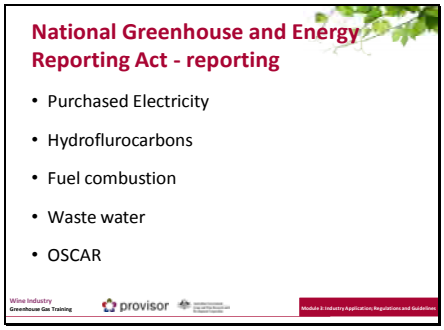
How much is 100 TJ energy or 25ktCO_2-e GHG emissions?

- 20,000-30,000 MWhr/yr of electricity consumption, depending on state
- 2,600 kL of Diesel is 100TJ (but only 7 kt CO_2-e)
- 3,000 kL of Petrol is 100TJ (but only 6.9 kt CO_2-e)
- As a rough guide, it is recommended that companies with an annual crush of over 15,000 T seek further advice on reporting requirements

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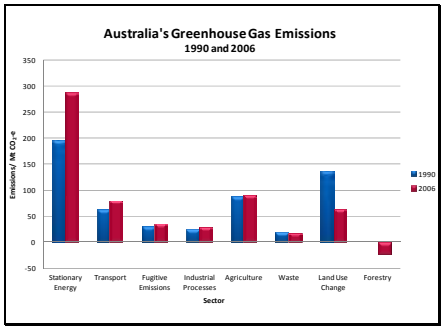


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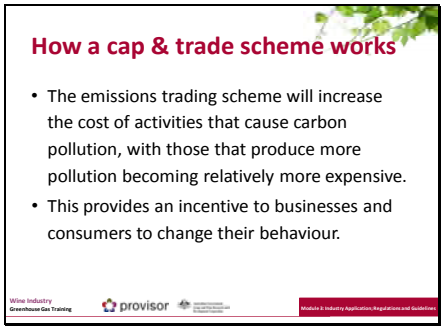


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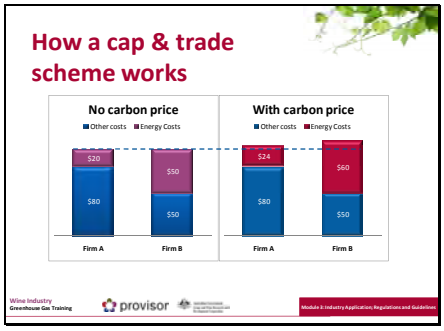


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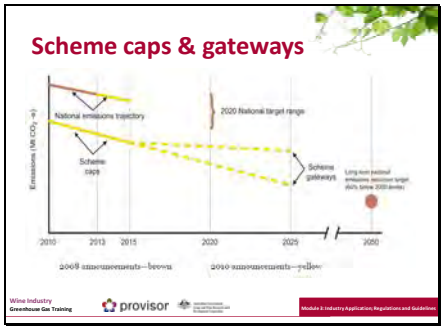


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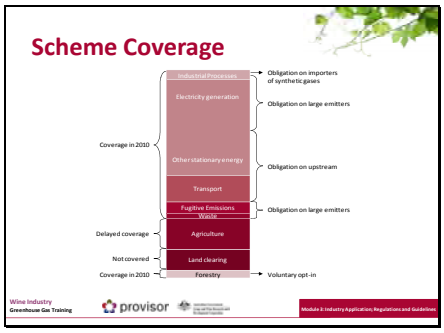
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Agriculture and the CPRS

- Agriculture emissions contributed approximately 16 % of Australia's GHG emissions in 2006
- Agriculture is the main source of methane (primarily from livestock) and nitrous oxide (mainly from agricultural soils) emissions
- The current proposal is that Agriculture is to be included by 2015, with a final decision on inclusion to be made in 2013

Slide 20

Agricultural emissions

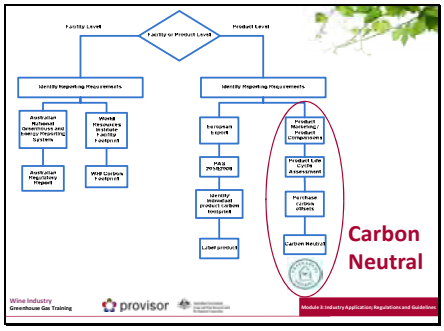
Source	GHG Emissions/Mt CO_2-e
Livestock	**62.1**
Enteric fermentation (feed digestion)—cattle	44.0
Enteric fermentation—sheep	14.4
Enteric fermentation—other (for example, goats, horses)	0.3
Manure management	3.4
Agricultural soils	**16.6**
Direct soil emissions	Not included in accounts
Synthetic fertilizers	3.3
Other (manure fertiliser, nitrogen-fixing crops, crop residues)	2.1
Animal production (nitrogen excretion on land)	4.3
Indirect emissions (leaching and runoff)	6.6
Other (soil disturbance)	0.3
Prescribed burning of savannas	**0.7**
Rice cultivation	**0.2**
Field burning of agricultural residues	**0.4**
Total	**87.9**

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Vineyard Agricultural Emissions

- Main source is nitrous oxide fertiliser emissions
- Emissions are affected by farm practices, e.g. soil moisture content
- Nitrous oxide emissions from a biological system are a waste of production resources
- Emission factors used for national GHG accounts may not be accurate at farm level
- Increased utilisation of nitrogen can reduce emissions and increase productivity
- Further research is planned in this area

Slide 22

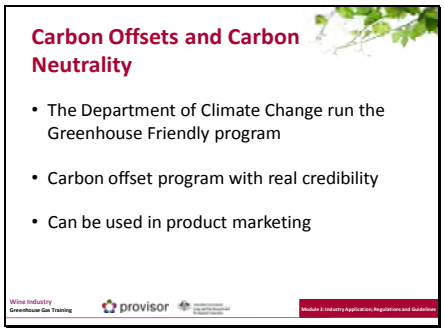


Slide 23



video

Slide 24



Slide 25

Greenhouse Friendly Certification

1. Prepare life cycle assessment for product
2. Develop emissions monitoring plan
3. Have reports independently verified
4. Submit application
5. Maintain certification

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Cascade Green 100% Carbon Offset

Research by Foster's indicated that 81% of Australians were interested in purchasing products that were more environmentally friendly, and led them to develop the Cascade Green beer under the Greenhouse Friendly scheme.



Slide 27

Creating Forest Sinks

- Have a minimum area of 0.2 hectares
- Have a minimum width of 10m
- Have a potential height of at least 2m
- Have a minimum of 20% potential crown cover
- Be established on land that was not forested on 31 December 1989



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Greenwashing

Greenwash – *verb:* the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service.

TerraChoice 2007



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Greenwashing – The six sins

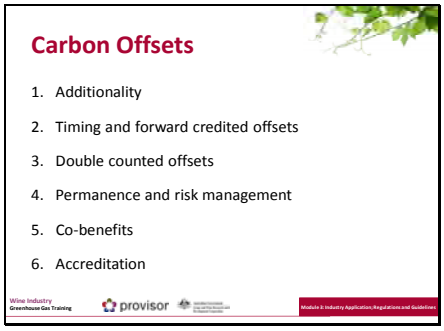
1. Sin of the Hidden Trade-Off
2. Sin of No Proof
3. Sin of Vagueness
4. Sin of Irrelevance
5. Sin of Lesser of Two Evils
6. Sin of Fibbing

Slide 30

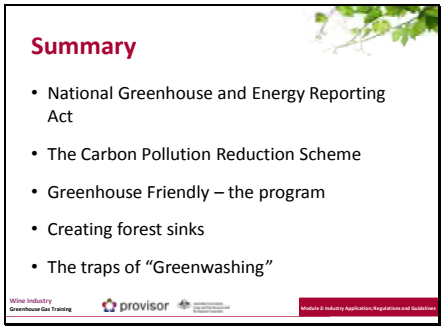
The ACCC and carbon claims

- Think about the **message** that will be taken away by your target audience
- Provide accurate and complete information to consumers
- Misleading conduct can include **silence**
- **Clarify** your carbon claims
- When making claims of **carbon neutrality**, spell out exactly what is included in your claim to avoid misleading consumers
- If you are making statements as to the future, ensure you have a **reasonable basis**

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NATIONAL GREENHOUSE AND ENERGY REPORTING (NGER) ACT

OVERVIEW

In September 2007 the *National Greenhouse and Energy Reporting Act 2007* was passed, establishing a comprehensive mandatory corporate reporting system for greenhouse gas emissions, energy consumption and production. The scheme is referred to as the National Greenhouse and Energy Reporting Scheme (NGERS).

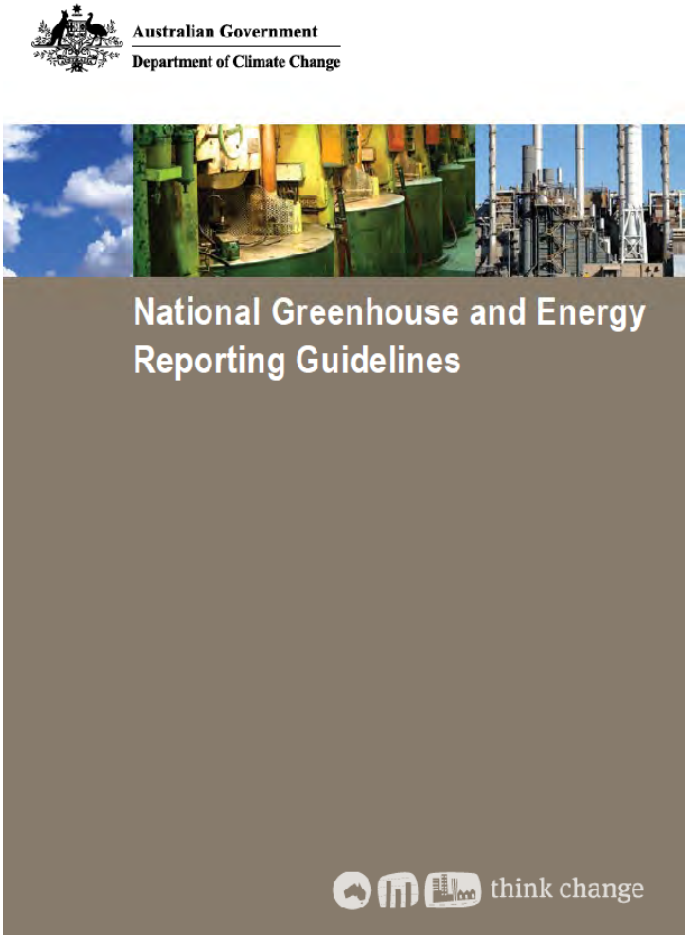
The stated purpose of the act is to (37):

- Underpin the introduction of an emissions trading scheme in the future;
- Inform Government policy formulation and the Australian public;
- Meet Australia's international reporting obligations under the Kyoto Protocol;
- Assist Commonwealth, State and Territory Government programs and activities; and
- Avoid the duplication of similar reporting requirements in the States and Territories.

The first reporting period commenced on 1 July 2008 and applies to:

1. Corporate groups that emit more than 125kt CO_2-e/yr or consume more than 500TJ of energy; and
2. Single facilities that emit more than 25kt CO_2-e/yr or consume more than 100TJ of energy.

Over the course of three years, these thresholds will decrease. The progressive reduction in reporting thresholds for corporate groups is shown in Table 4. Note that there is no change to the single facility threshold that remains at 25kt CO_2-e/yr.



The thresholds for energy consumption and production apply independently, i.e. a facility that **produces** 50TJ of energy, and **consumes** 50TJ of energy does not meet the 100TJ threshold.

The thresholds for greenhouse gas emissions and energy consumption will be reached at different times, depending on the types of energy use of the facility. For example, if a facility uses 2,600 kL of diesel for transport in one year, it will be required to report under the energy consumption threshold, but not the greenhouse gas threshold.

Table 4 – Reporting thresholds and dates for the NGER Scheme (37)

	2008 -2009 Reporting year 1	2009 -2010 Reporting year 2	2010 - onwards Reporting year 3 onwards
Facility thresholds	25 kt CO_2-e 100 TJ	→	
Corporate group thresholds	125 kt CO_2-e 500 TJ energy	87.5 kt CO_2-e 350 TJ energy	50 kt CO_2-e 200 TJ energy
Corporations to apply for registration by	31 August 2009	31 August 2010	31 August 2011
Corporations to report by	31 October 2009	31 October 2010	31 October 2011
Government to publish data by	28 February 2010	28 February 2011	28 February 2012

DEFINING A FACILITY

Defining a facility, that may itself meet the reporting threshold, or be part of a corporation that meets the reporting threshold, is central to the NGERS. The four criteria that are used to define a facility are as follows:

1. Activities must produce greenhouse gas emissions, or produce or consume energy.

The six types of gases in the Kyoto Protocol are included, with the emissions including only Scope 1 and Scope 2 activities.

2. Activities are part of a production process.

Under the Act, a series of activities occurring at a single site producing a product or service is defined as a production process. For example, winemaking and bottling occurring at a single site would be defined as part of the winemaking production process.

Other production processes that also occur on the site are generally included as part of the facility. The exception is if they are under the control of a separate corporation and the products are not used in the primary product process.

3. Activities occur at a 'single site'.

The definition of a 'single site' under the NGERS is *"a single physical area that can include a series of geographical locations in close proximity to one another".* Applied to the wine industry, this means that company owned vineyards near the winery could be considered a single site, and the lower facility threshold would apply, rather than the higher corporation threshold. It is recommended that further advice be sought on this issue from the Department of Climate Change, if relevant.

4. Activities are attributable to a single industry sector.

The product or service produced by the facility must be attributable to a single industry sector, as defined

How much is 100 TJ of energy or 25ktCO_2-e of greenhouse gas emissions?

- 20,000-30,000 MWhr/yr of electricity consumption, depending on state
- 2,600 kL of diesel is 100TJ (but only 7 kt CO_2-e)
- 3,000 kL of petrol is 100TJ (but only 6.9 kt CO_2-e)

Energy use and emissions can vary significantly between vineyards and wineries, depending on size, equipment type and efficiency etc. As a rough guide, it is recommended that companies with an annual crush of over 15,000 T seek further advice on reporting requirements.

An online calculator to help determine obligations is available at: http://www.climatechange.gov.au/reporting/calculator

Seek further advice if your are unsure

under the Australian New Zealand Standard Industry Classification (ANZSIC) system.

DEFINING OPERATIONAL CONTROL

In order to ensure that emissions are fully accounted for, and not double counted, it is necessary to define clear organisational boundaries for reporting. The Greenhouse Gas Protocol defines two possible methods of setting organisational boundaries: based on equity share, and based on control. For the NGER, the method based on operational control is employed.

Under the NGERS, a corporation is considered to have operational control over a facility if the corporation has authority to introduce and implement operating, health and safety, and environmental policies. Only one corporation can have operational control over a facility at any time (37).

If there is uncertainty about which corporation has operational control over a facility, the corporation deemed to have operational control will be the one with the greatest authority to introduce and implement operating and environmental policies.

The company that is deemed to have operational control is responsible for reporting all emissions and energy data for a facility, including contractor and sub-contractor activities, assuming the relevant threshold is met. That is, the corporation with operational control is responsible for collecting contractor data and incorporating the data in its own report.

A decision tree to assist in determining operational control is shown in Figure 14.

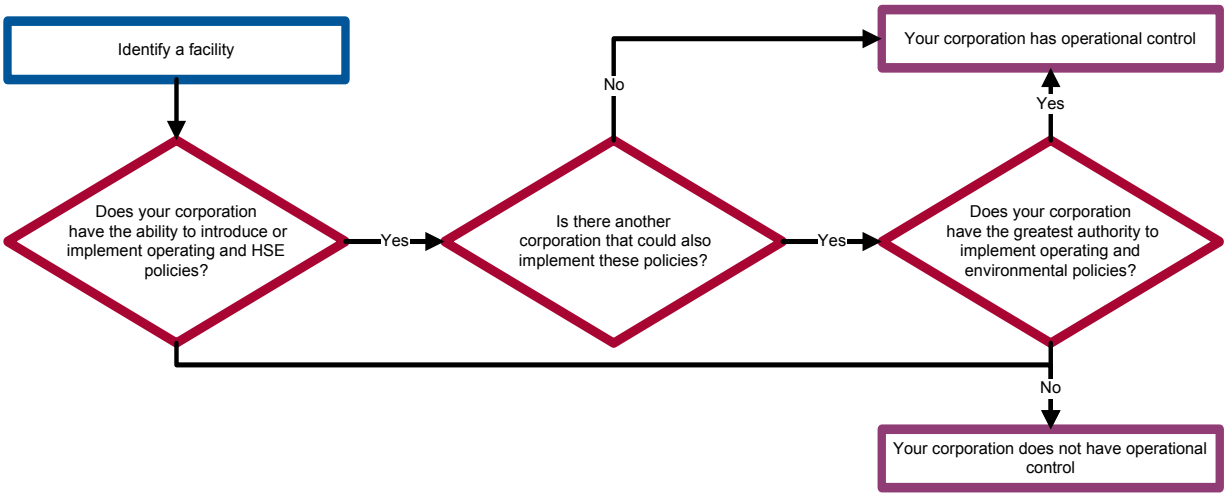
As large corporations often have complex financial and ownership structures, defining operational control may not be straight forward. In this case legal advice should be sought. Under the NGERS, the Greenhouse and Energy Data Officer in the Department of Climate Change is able to make specific determinations on operational control for a facility. Details on this process are available from the Department of Climate Change website.

REGISTRATION

Registration by companies meeting the threshold in the 2008-2009 financial year is required by 31st August 2009. Registration is via an online tool available at the Department of Climate Change website.

Voluntary registration will be possible for companies undertaking a greenhouse gas reduction project. Details on the project criteria and requirements are to be confirmed by early 2009.

Figure 14 – Flowchart guidelines on how to determine operational control (37)



REPORTING

The obligations for reporting are detailed in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008 Act*, and interpreted in the more user-friendly *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008* (the Technical Guidelines) (38).

For each source of greenhouse gas emissions, the Technical Guidelines detail a number of methods that can be used to estimate the quantity of emissions to be reported.

Some of the guidelines expected to be relevant to wine producers are summarised as follows (38):

1. Purchased Electricity (Scope 2 emissions)

For purchased electricity, the emissions must be estimated using the average electricity grid emission factors for the relevant reporting period as published by the Department of Climate Change. This means that there is ***no specific reduction in emissions for companies that purchase Green Energy***. The basis for this decision is that the grid emissions factors already include the Green Energy electricity sources, and the use of the average emission factors ensures that emissions are fully accounted for and not double counted. As the results of the reporting will be made public, there is scope for companies to provide additional data on the use of Green Energy if desired.

2. Hydrofluorocarbon Emissions

Hydrofluorocarbon emissions are mainly due to refrigerant gas losses from air conditioner and refrigeration systems. As there are potentially many sources of these gases in a large facility, emissions of hydrofluorocarbon gases need only be estimated and reported if all of the following conditions are met:

- The equipment containing the HFC is a commercial or industrial refrigeration or air conditioning plant;
- Each piece of equipment contains a refrigerant charge of more than 100 kg; and
- The refrigerants have a weighted-average Global Warming Potential of over 1000.

Some refrigeration plants used in wineries are expected to meet these conditions.

Note that emissions of chlorofluorocarbon's (CFC's) and hydrochloroflurocarbon's (HCFC's) are not required to be reported, as although they can have a high global warming potential, they are also ozone depleting substances and are currently being phased out under the Montreal Protocol. A common HCFC is R-22, used in many air-conditioning and refrigeration systems. As per Green Energy, there is scope for optional reporting of other gases, including CFC's and HCFC's.

3. Combustion of Gaseous and Liquid Fuels

A number of methods are included in the Technical Guidelines for estimating greenhouse gas emissions from the combustion of gaseous and liquid fuels.

The first method uses the energy content of the fuel and emission factors for each greenhouse gas produced during combustion (CO_2, CH_4, N_2O). Specific emission factors are published in the Technical Guidelines for different fuels according to type of use (stationary combustion, transport etc). Some of the emission factors have been updated in the Act from the values in the *NGA Factors* workbook.

Alternative methods include sampling and analysis of fuels consumed to determine composition and energy content, for example, the methane content of the combusted gas. These methods are designed to enable more accurate estimates of emissions at a particular facility.

4. Wastewater Handling (industrial)

Emissions from a winery wastewater treatment plant, where the plant is controlled by the winery, are to be reported under industrial wastewater handling. These emissions only include methane generated from anaerobic treatment of wastewater, and the methane and nitrous oxide emissions from flaring of any biogas. Note that carbon dioxide from wastewater treatment or flaring is considered to be from a biogenic source, so it is not included.

Various methods are available to estimate the emissions from a wastewater facility. Method 1 follows the method in the *NGA Factors* workbook, with the use of default values for chemical oxygen demand (COD) for each industry. For wineries, the default COD of 1.5 kg/m^3 must be used for method 1.

Method 2 uses a similar calculation as method 1, but with sampling, conducted according to the *Technical Guidelines*, and analysis, conducted according to the relevant Australian Standard, of the wastewater to determine the COD.

Method 3 is also defined, and is similar to method 2, but with sampling conducted according to the relevant Australian Standard, rather than the *Technical Guidelines*.

Methane and nitrous oxide emissions must also be estimated for any sludge biogas flaring operations, by either Method 1, following the method in the *NGA Factors* workbook, or by Methods 2 or 3 that include sampling and analysis of the fuel to estimate the gas composition.

OSCAR

For companies required to report under the NGERS, data will be reported to the Government using the Online System for Comprehensive Activity Reporting (OSACR). An earlier version of OSCAR was used for the Greenhouse Challenge Plus Program, and it is currently being upgraded for the NGER. The tool will include all the current emission factors and calculate the greenhouse gas emissions from primary activity data entered, for example electricity use.

AUDIT AND COMPLIANCE

Under the NGERS, there is scope for auditing of corporation's reports as follows:

1. If non-compliance is suspected, an audit can be initiated by the Greenhouse and Energy Data Officer at the corporation's expense.

2. An audit can also be initiated by the Greenhouse and Energy Data Officer as part of a wider compliance strategy, at the Department of Climate Change's expense.

Guidelines on the audit process are currently being developed in consultation with industry and are expected to be available in late 2008.

EMISSIONS TRADING AND THE PROPOSED CARBON POLLUTION REDUCTION SCHEME

The current Government has committed to introducing an emissions trading scheme in 2010, and recently released a Green Paper on a proposed Carbon Pollution Reduction Scheme for public consultation (39). The Green Paper is a detailed document on the Government's preferred positions on the numerous mechanisms and intricacies of how an emissions trading scheme might work in Australia.

In preparing the green paper, the Government drew on the work of the Garnaut Climate Change Review, the previous Government's Task Group on Emissions Trading and the states and territories' National Emissions Trading Taskforce, among other sources.

However, the purpose of the Green Paper is to generate discussion, and submissions from interested parties, such as industry groups, that are likely to influence some of the Government's preferred positions.

The Green Paper does not detail emissions targets or trajectories, except for a long term goal of emissions reductions to 60% below the year 2000 levels by 2050. Economic modelling studies by the Department of Treasury and by the Garnaut Review on the economic costs of different paths of action, along with submissions received will be used to develop the final framework.

A key message in the Garnaut Review and the Green Paper is that the costs of inaction on addressing climate change from damage or asset loss are highly likely to exceed the costs of adaptation, and that inaction or continual delay on addressing climate change is making a decision to accept these consequences.

OBJECTIVES OF THE GOVERNMENT'S CLIMATE CHANGE STRATEGY

The Green Paper details the Australian Government's three pillar climate change strategy, including:

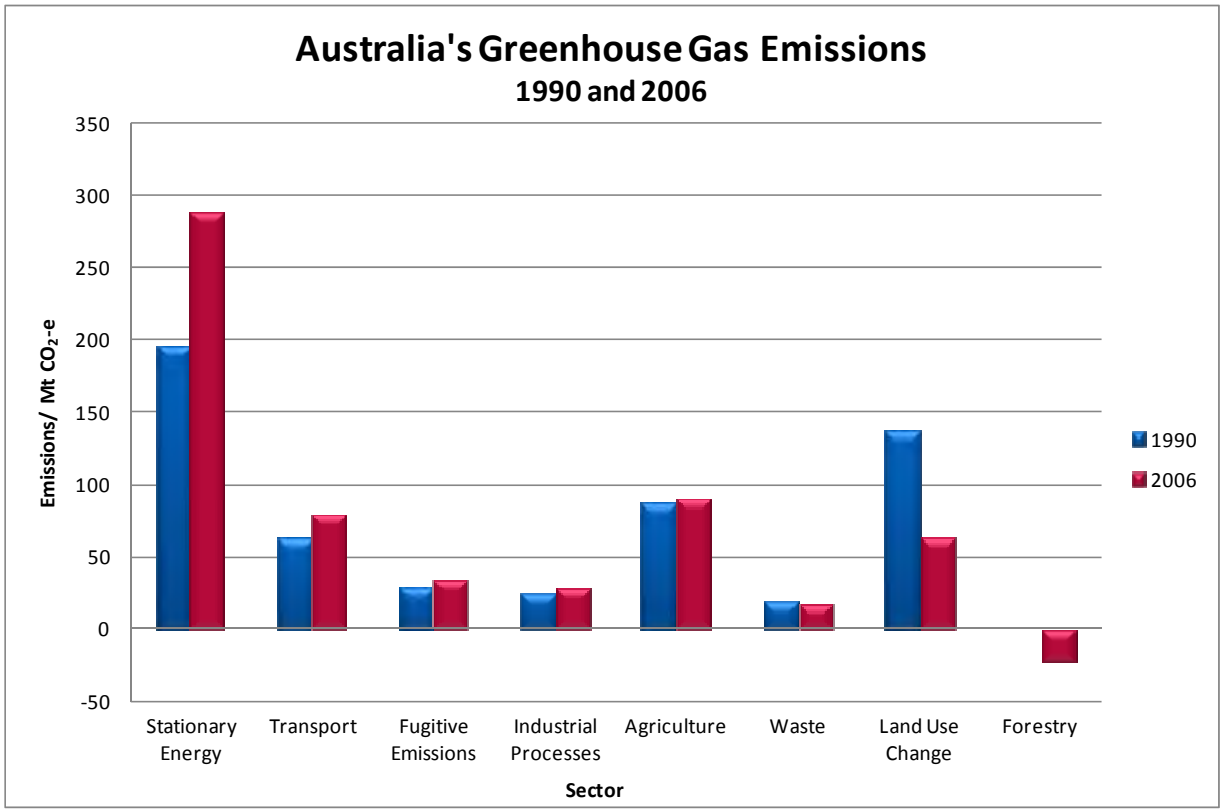
1. Reducing Australia's Greenhouse Gas Emissions

The Government has made a commitment to reduce Australia's greenhouse gas emissions to at least 60% below the year 2000 levels by 2050, and the Carbon Pollution Reduction Scheme is to be the main market-based mechanism to achieve this reduction. A breakdown of emissions by section in 2006 is shown in Figure 15.

Professor Ross Garnaut recently released the final report of the Garnaut Climate Change Review, including recommendations on emissions trajectories (10). The Review concluded that, while strongly desirable for Australia and the world, reaching an international agreement to stabilise greenhouse gas levels at 450 ppm CO_2-e will not be easy to reach and would require emission reductions from both developed and developing countries that go beyond what is being contemplated in any but a few countries.

The review recommended supporting a 450 ppm objective, but suggested that the chances of reaching a agreement of 550 ppm are much higher (10). For Australia, a 550ppm target would require a reduction of 10% from 2000 levels by 2020 (30% per capita), and 80% by 2050 (90% per capita). In the absence of an international agreement, a target of 5% by 2020 and 60% by 2050 was recommended. The targets were worked out using a global model that converged to equal emissions per capita for each country by 2050.

Figure 15 – Australia's Greenhouse Gas Emissions in 1990 and 2006 (40)



2. Adapting to unavoidable climate change

The effects of climate change are already observable, with some of the examples given earlier in this manual. Climate change in Australia will be determined by global emissions increases because Australian emissions are very small in the global context.

The Government has started to work with industry, state, territory and local Governments and scientists to develop the tools to enable all Australians to better prepare for the changes ahead. An example of work occurring in this area is the Australia's Farming Future strategy, being run by the Department of Agriculture, Fisheries and Forestry. It will provide $130 million over four years to help primary producers adapt and respond to climate change.

3. Contributing to shaping a global solution to save the planet and advance Australia's long term interests.

It is widely recognised that Climate Change is a global problem, requiring a global solution. Australia will not be the first country to introduce an emissions trading scheme, with a scheme already operating in Europe, and other countries including New Zealand and Japan soon to introduce schemes. However, Australia's commitment to addressing climate change will encourage others to also join the fight. The Government plans to take the evolving state of international negotiations into account when determining the path set to meet the chosen target.

It is argued that Australia will be impacted more by the effects of climate change than other countries, so we have a lot to gain from reaching an international agreement on emissions reduction. Our credibility in this process depends on our own action being early and decisive (14).

HOW A CAP AND TRADE SCHEME WORKS

The proposed Carbon Pollution Reduction Scheme is based on a "cap and trade" system. This is essentially a market based mechanism based on the fundamentals of supply and demand:

- Supply is created by the issue of permits, by a regulator, to release carbon pollution; and
- Demand is created by the requirement to surrender permits equal to the amount of carbon pollution released.

A summary of how the proposed scheme works is (39):

1. The Government sets a target for the total amount of carbon pollution to be emitted and counted in the National Greenhouse Accounts;
2. The Government sets a cap on the total amount of carbon pollution allowed to be emitted by sectors covered by the scheme in order to achieve the national target. The cap will be less than the national emissions target, and will require estimating the likely emissions from the sectors not covered by the scheme;
3. The Government will issue permits up to the annual cap each year;
4. Industries covered by the scheme that generate carbon pollution will need to acquire a 'permit' for every tonne of greenhouse gas that they emit;
5. The quantity of carbon pollution produced by each firm will be monitored and verified;
6. At the end of each year, each liable firm would need to surrender a permit for every tonne of carbon pollution the firm produced in that year;
7. Firms compete in the market to purchase the number of permits that they require. Firms that value the permits most highly will be prepared to pay the most for them, either at auction, or on a secondary trading market. For some firms, it will be cheaper to reduce emissions than to buy permits; and
8. As a transitional assistance measure, certain categories of firms might receive some emissions permits for free. These firms could use these permits or sell them.

PURPOSE AND EFFECT OF AN EMISSION TRADING SCHEME

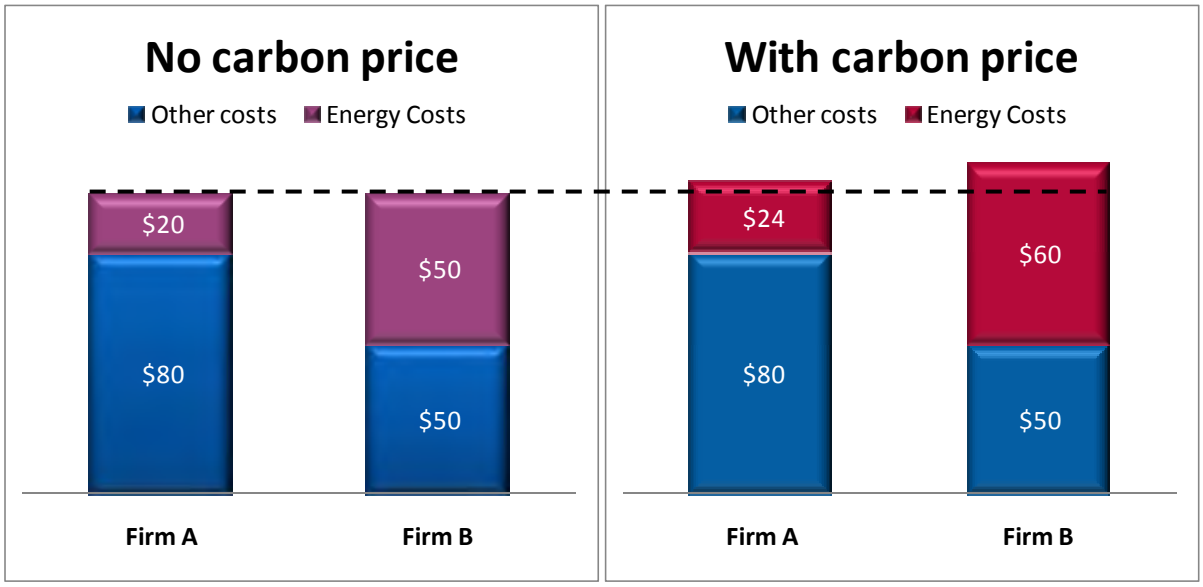
The purpose of an emissions trading scheme is to provide a strong incentive for businesses and consumers to reduce carbon pollution. It is proposed that a market based mechanism will allow this to occur at the least cost to businesses and hence the economy. This will occur by encouraging those businesses that can reduce carbon pollution at the lowest cost to do so first.

The emissions trading scheme will increase the cost of activities that cause carbon pollution, with those that produce more pollution becoming relatively more expensive. This provides an incentive to businesses and consumers to change their behaviour.

The effect of pricing carbon is expected to be a major economic reform, and will change the things we produce, the way we produce them and the things we buy – in essence our everyday lives.

An example of the effect of a price on emissions on the cost of goods is shown in Figure 16. In this case the cost of electricity is assumed to increase by 20% due to the requirement to buy carbon pollution permits. If all of this cost is passed on to consumers, the price of the goods of firm A will rise 4%, while the cost of goods of firm B will rise 10% due to the differences in the amount of energy used to produce the goods. This will give an incentive for the consumer to switch to goods from firm A, and for firm B to improve energy efficiency.

Figure 16 – Effect of an emissions trading scheme on the costs of goods (39)



SETTING SCHEME CAPS AND GATEWAYS

The Green Paper indicates that the Government will provide an emissions reduction target for 2020 by the end of 2008. This will help to define the trajectory towards the long term 2050 target. To encourage business confidence in the market and ensure stability, there are proposed mechanisms to progressively announce the targets for the carbon pollution cap:

- Emissions trajectories will be announced on a rolling 5 year basis. The initial announcement will be for years 1 to 5, or 2010-2015. Towards the end of year 1 (mid-2011), the trajectory for year 6 (2016) will be announced.
- It is proposed that longer term indication of the emissions trajectory be provided in the form of "gateways", a range within which the emissions trajectory will be set. The gateway will exist for a minimum of 5 years past the yearly target range. Initially, the gateways for 2020 and 2025 will be set. The 2030 gateway will then be set in 2015.
- The Green Paper indicates that the Government proposes to advise gateways for 10 years beyond the 5 year rolling trajectory.

A schematic of the proposed cap and gateway mechanisms is shown in Figure 17.

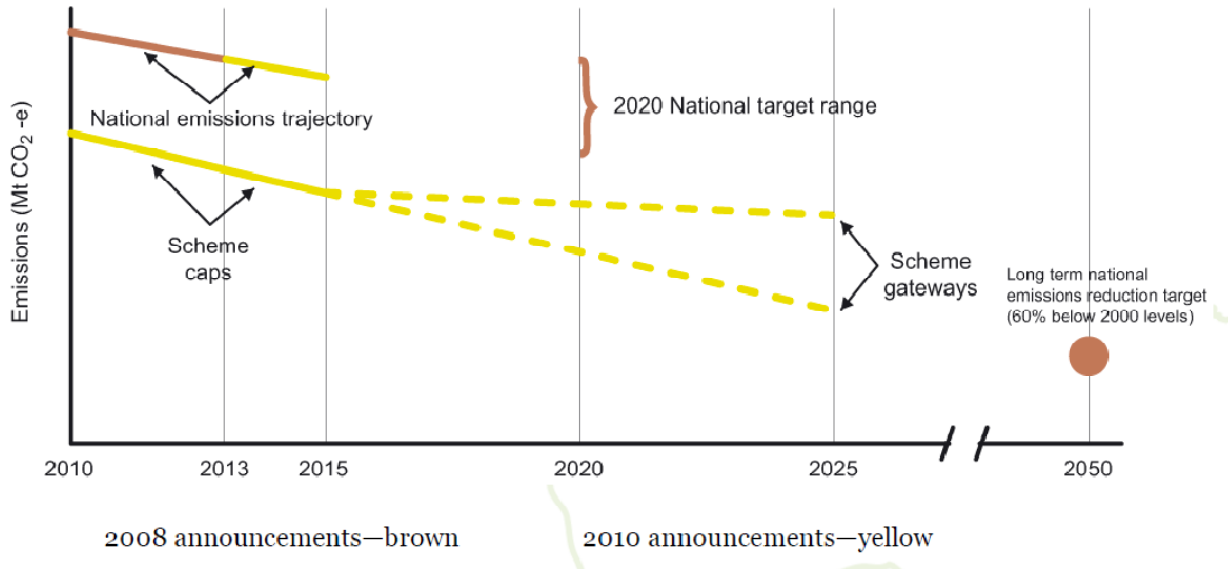
DIFFERENCE BETWEEN AN ETS AND A CARBON TAX

There are a number of advantages of an emissions trading scheme over a carbon tax detailed in the Green Paper.

A straight Carbon tax could be imposed by the Government by setting a price for a permit to emit carbon pollution. However, this does not set a direct limit on the total amount of carbon pollution. Setting the level of the tax to accurately meet the carbon pollution target would require the Government to collect a significant amount of information, which is not considered feasible.

In addition, emissions trading schemes are emerging as the preferred approach in other countries, and will eventually allow Australia to link with these schemes and be part of a global cap on carbon pollution.

Figure 17 – Proposed Carbon Pollution Reduction Scheme target and gateway framework (39)



COVERAGE

The proposed sectors to be included in the scheme have been chosen to give the widest possible coverage of the scheme and to achieve the lowest-cost emissions reductions. Each sector has differences in how the scheme will be administered, with the aim of minimising transaction and compliance costs.

For the most part, the companies with direct obligations for purchasing will be those required to report under the NGERS. The current proposed design of the scheme is expected to cover about 75 % of Australia's emissions and place the obligation to buy permits on around 1000 companies (39).

A summary of the coverage is shown in Figure 18, with a summary of the proposed arrangements and likely impact in each sector following.

ELECTRICITY GENERATION

The proposed scheme will make the large electricity generators liable for purchasing permits for each tonne of carbon pollution emitted. This means that companies using electricity are not liable for purchasing permits for emissions associated with electricity generation. This differs to the NGERS where electricity use counts toward a company's energy consumption and emissions.

These costs incurred by electricity generators having to purchase carbon pollution permits will be passed on to the consumers of electricity via increases in the electricity price.

OTHER STATIONARY COMBUSTION

Large users of fuel for stationary combustion will be required to report and purchase credits as per electricity generators.

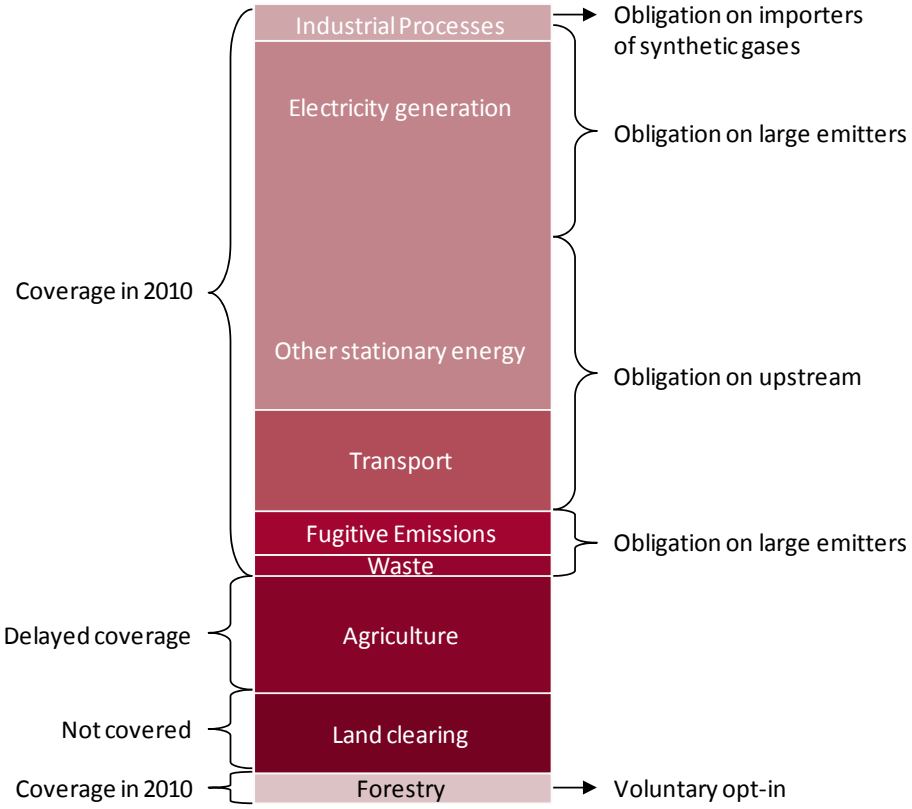
Smaller users of fuel not required to report will be covered by placing obligations to buy permits on the companies that supply the fuel. These companies will then pass the cost on to the consumers of the fuel.

TRANSPORT

There are many small emitters in the transport sector i.e. everyone that operates a vehicle. Coverage will be achieved by placing obligations to buy permits on the companies that supply the fuel. Again, these companies will then pass the cost on to the consumers of the fuel.

However, due to the already significant recent increase in fuel prices, the Government is considering cutting fuel taxes on a cent for cent basis to offset cost of the scheme for the first three years.

Figure 18 – Proposed coverage of the Carbon Pollution Reduction Scheme by sector (39)



INDUSTRIAL PROCESSES

Industrial processes (chemical reactions in manufacturing, mineral processing and chemicals and metals production) will be included in the scheme. Most industrial processes that result in carbon pollution are large enough to meet the reporting thresholds.

AGRICULTURE

Agriculture emissions contributed approximately 16 % of Australia's greenhouse gas emissions in 2006 (40). Agriculture is the main source of methane (primarily from livestock) and nitrous oxide (mainly from agricultural soils) emissions. The current proposal is that agriculture be included by 2015, with a final decision on inclusion to be made in 2013.

A breakdown of the sources of emissions in agriculture is shown in Table 5. As discussed in Chapter 1, Australia has chosen not to include soil carbon emissions under section 3.4 of the Kyoto Protocol.

In the agriculture sector, there are a large number of parties that emit smaller amounts of carbon pollution, and there are significant challenges in accurately estimating the emissions.

In addition, there are a number of practices on the farm that significantly influence the amount of greenhouse gas released. For example, the soil moisture content when nitrogen containing fertiliser is applied significantly influences the amount of nitrous oxide released (23). This makes it difficult to apply obligations to purchase permits on the fertiliser producer or distributor and give the right incentive for the fertiliser users to reduce emissions.

Nitrous oxide emissions from a biological system are a waste of production resources i.e. soil nitrogen content. In addition, the existing emission factors used to calculate nitrous oxide emissions have been derived for the purposes of international accounting, and may not be accurate when applied at the vineyard level due to various environmental factors and management practices. The case of farmers reducing fertiliser application in response to emissions measurement could lead to a reduction in productivity if not managed carefully. Alternatively, if steps can be taken to increase the utilisation of nitrogen, this can decrease emissions and increase productivity at the same time.

A consultation process with the agriculture industry is continuing, and the decision on inclusion is likely to be influenced by developments in the ability to accurately estimate emissions.

Table 5 – Breakdown of Emissions from Agriculture in Australia in 2006 (40)

Source	Greenhouse gas emissions/Mt CO_2-e
Livestock	**62.1**
Enteric fermentation (feed digestion)—cattle	44.0
Enteric fermentation—sheep	14.4
Enteric fermentation—other (for example, goats, horses)	0.3
Manure management	3.4
Agricultural soils	**16.6**
Direct soil emissions	Not included in accounts
Synthetic fertilizers	3.3
Other (manure fertiliser, nitrogen-fixing crops, crop residues)	2.1
Animal production (nitrogen excretion on land)	4.3
Indirect emissions (leaching and runoff)	6.6
Other (soil disturbance)	0.3
Prescribed burning of savannas	**8.7**
Rice cultivation	**0.2**
Field burning of agricultural residues	**0.4**
Total	**87.9**

LAND USE CHANGE

Reforestation or the conversion of land used for other purposes to forestry is to be included in the scheme on a *voluntary* basis from scheme commencement. This is the only sector that will be able to generate permits, allowing the permits to be sold to other companies to emit. Further information on forest sink projects is contained later in this chapter.

The Government's preferred position is to not include deforestation, or the conversion of forested land to other purposes in the Carbon Pollution Reduction Scheme, as they believe existing systems set-up to discourage land clearing are sufficient.

WHAT IS THE MONEY TO BE USED FOR?

The sale of the permits via auction will generate large amounts of revenue for the Government. The Government has committed that every cent raised from the Carbon Pollution Reduction Scheme will be used to help Australian households and businesses adjust to the scheme and to invest in clean energy options.

A Climate Change Action Fund has also been proposed, that will be used for:

- Capital investment in innovative new low emissions processes;
- Industrial energy efficiency projects with long payback periods; and
- Dissemination of best and innovative practice among small to medium sized enterprises.

IMPACT ON CARBON OFFSETS

There is currently a growing market for voluntary carbon offsets in Australia, but the introduction of an emissions trading scheme is likely to significantly change this market.

Currently, carbon offsets can be generated when a business implements a project that will result in less carbon pollution being released than would otherwise be the case.

For example, a project could include capturing methane gas from a landfill site and using it to generate electricity. Following certification under a relevant scheme, credits are given to the company for the amount of methane that would otherwise be released, and these can be sold to other companies wishing to offset their emissions.

Due to the broad coverage of the emissions trading scheme, there will be limited scope for companies to generate offsets once the scheme commences. For example, if a sector is covered by the scheme, implementing a project that results in less carbon pollution being released, such as methane capture from landfill, will only result in that company having to buy fewer permits. The exception is forestry, where voluntary opt-in is proposed. Reforestation projects must be eligible to be counted towards Australia's Kyoto obligations, and additional permits above the cap will be given to owners based on the amount of carbon stored. Under current international rules, the owners are also liable for purchasing permits if the carbon is released in the future, for example if the trees are harvested. Vineyards are unlikely to meet the definition of a forest under Kyoto rules.

A further problem with offsets is the developing a standard for determining the baseline case to measure the emissions reductions against. This difficulty is inherent in all existing carbon offset programs. For the sectors that are not covered by the scheme, or those with delayed coverage (agriculture), the Government's preference is not to develop the required standards and methodologies to quantify offsets, but to maximise the coverage of the Carbon Pollution Reduction Scheme.

DEPARTMENT OF CLIMATE CHANGE'S GREENHOUSE FRIENDLY PROGRAM

For companies wishing to gain market advantage through a proactive approach to addressing climate change, one option in Australia is to join the Department of Climate Change's Greenhouse Friendly program.

Greenhouse Friendly products and services undergo a rigorous certification process that ensures the lifecycle, or 'cradle-to-grave' greenhouse gas emissions associated with the production, use and disposal of certified products or services are fully offset by Greenhouse Friendly approved carbon offsets.

Possible benefits of achieving Greenhouse Friendly certification for a product or service include

- Product or service differentiation in the market;
- Scheme is endorsed by the Australian Government with high standards for both the required lifecycle assessment and for offset providers;
- Improved investment profile in the minds of company stakeholders;
- Improved risk management though following the rigorous measurement, reduction, offset and monitoring process; and
- Marketing support from the Greenhouse Friendly team.

PROCESS

The process to achieve Greenhouse Friendly certification is summarised as follows:

1. Prepare life cycle assessment for product

A life cycle assessment of the Greenhouse gas emissions is required for the product or service. This must be conducted and reported according to the current Australian Standard for LCA in the ISO 14040 series. The assessment can be completed in-house or with the help of a consultant.

2. Develop emissions monitoring plan

The emissions monitoring plan (EMP) must detail the systems in place for the ongoing monitoring of all sources of greenhouse gases indentified in the life cycle assessment. This includes details of measurement plans, measurement equipment, role responsibilities, staff training, updating of emission factors etc.

3. Have LCA and EMP independently verified

Both the life cycle assessment and the emissions monitoring plan documents must be verified by an approved independent verifier. The verifier must not have been involved in the preparation of the documents.

4. Submit application

The documents above are submitted to the Department of Climate Change who make a decision on the application.



5. Maintain certification

The process to maintain certification involves following the emissions monitoring plan, purchasing the required amount of carbon offsets each year, and submitting an independently verified annual report.

LONG TERM FUTURE

A key part of the current Greenhouse Friendly scheme is the purchase of carbon offsets.

As explained previously, the introduction of a comprehensive emissions trading scheme will considerably impact the ability to generate carbon offsets.

The introduction of the Carbon Pollution Reduction Scheme scheduled for 2010 is therefore likely to have an impact on the Greenhouse Friendly program.

Case Study: Cascade Green

Research by Foster's indicated that 81% of Australians were interested in purchasing products that were more environmentally friendly, and led them to develop the Cascade Green beer under the Greenhouse Friendly scheme. (46)

Foster's have reported that the early sales of Cascade Green exceeded their expectations and the company is using the knowledge gained from the project to improve its other production lines. (46)

They have also stated that the product development is part of an ongoing environmental improvement program at the Cascade Brewery, resulting in a reduction of carbon emissions by 16 % and water usage by 30 % per unit of production over the last six years. (47)

Foster's reported that the Greenhouse Friendly process for Cascade Green cost in the order of $150,000, including advice, verification and purchasing the initial offsets. (46)



CREATING FOREST SINKS

Under the proposed Carbon Pollution Reduction Scheme, reforestation projects could be eligible to generate carbon permits. A brief summary of the issues relating to creating forest sinks is included for landholders.

With the correct conditions and management, a new forest can be a significant contributor to removing carbon dioxide from the atmosphere and contributor to Australia's Kyoto Protocol target.

While the forest is actively growing and sequestering carbon, the system is termed a carbon sink (41). The rate at which forests grow and sequester carbon is influenced by characteristics such as climate, topography and the soil of the site. For a typical forest, growth tends to be slow in the initial years following planting as the trees are established. Sequestration rates generally peak when the trees are about 10 to 20 years old (earlier in faster-growing species), then gradually reduce. Other factors include the planting density, site preparation, tree survival rates, and ongoing protection from fire, pests and disease. If trees are not harvested they will continue to sequester carbon at a declining rate until reaching maturity at around 100 - 200 years of age, when growth is balanced by decay.

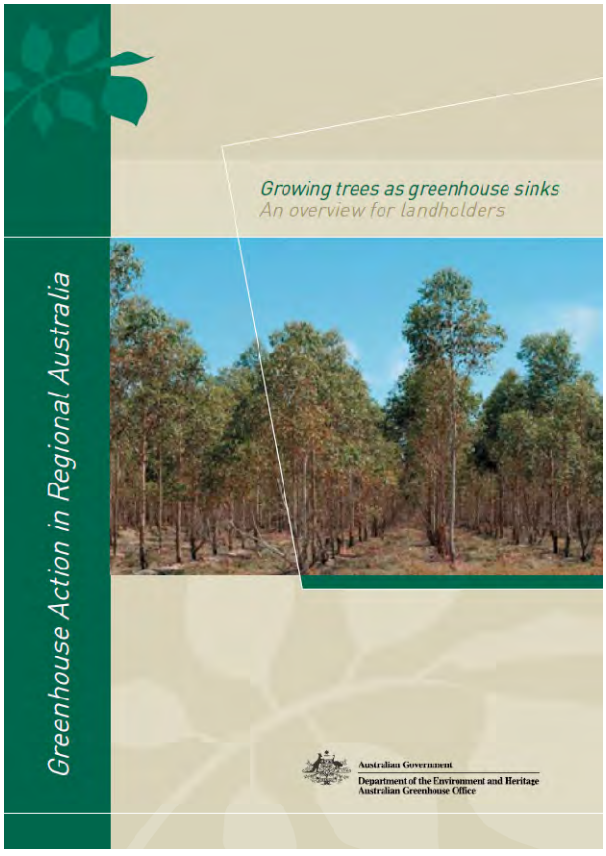
Certification of a forest to generate saleable carbon offsets under a scheme such as Greenhouse Friendly is potentially a complex and costly exercise. Certification costs could exceed $100,000. To reduce transaction costs, manage risks and obtain the necessary expertise, small growers and landholders may want to consider pooling approaches. Some state governments have enacted specific legislation to recognise ownership of carbon offsets separately from the ownership of land and trees.

To be counted towards Australia's obligations under the Kyoto Protocol, a forest sink project must:

- Have a minimum area of 0.2 hectares;
- Have a minimum width of 10 metres;
- Have a potential height of at least 2 m;
- Have a minimum of 20% potential crown cover; and
- Be established on land that was not forested on 31 December 1989.

Under the Kyoto Protocol, any carbon stored in the forest is deemed to be released when any timber is harvested, regardless of the end use of the timber, and should be considered when establishing the project.

Further information on forest sink projects is available at the Department of Climate Change website, http://www.climatechange.gov.au/land/forest-sinks.html.



GREENWASHING

Environmental marketing firm, TerraChoice, recently conducted a study of environmental claims of 1,018 different products in the North American market (42). The study drew attention to a number of patterns that they have defined as the "Six Sins of Greenwashing". These are:

1. Sin of the Hidden Trade-Off

This involves claiming that a product is environmentally friendly based on a single attribute, ignoring other potentially more important environmental impacts.

Suggestions for avoiding this sin include getting a good understanding the impact of the product across all environmental impact categories and sharing this with consumers.

2. Sin of No Proof

This included any environmental claim that was not backed-up by supporting information or relevant third-party certification.

Programs such as Greenhouse Friendly are designed to combat this issue by building a credible certification process.

3. Sin of Vagueness

This includes claims that are broad or poorly defined and could be misinterpreted by the consumer. An example would be use of the term "Carbon Neutral" without specifying the scope of the emissions that are considered.

In Australia, committing this sin could lead to breaches of the *Trade Practices Act*, as discussed further in the following section.

4. Sin of Irrelevance

This includes environmental claims that are true but not helpful to the consumer in evaluating the product, for example an environmental benefit that is shared by all products.

5. Sin of Lesser of Two Evils

This included claims that were true for the product, but the authors questioned the environmental value of the entire product category.

6. Sin of Fibbing

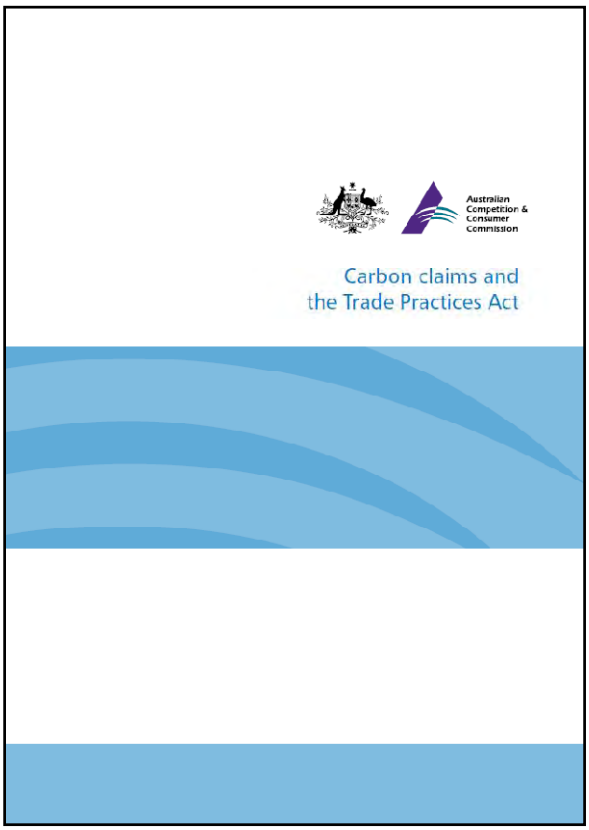
This included making claims that were just plain false, for example misrepresentation of certification. This is also likely to raise the attention of the Australian Competition and Consumer Commission (ACCC).

Greenwash – *verb:* the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service. (42)



ACCC REPORT: CARBON CLAIMS AND THE TRADE PRACTICES ACT

The ACCC recently released a report on how the Trade Practices Act applies to claims about carbon embedded in goods and services (31).



The *Trade Practices Act* prohibits misleading and deceptive conduct, and conduct that is **likely** to mislead or deceive.

Note that the conduct only needs to be **likely** to mislead or deceive. It does not matter whether anyone was actually misled, or whether the **intention** was to mislead anyone. The results of breaching the *Trade Practices Act* include penalties of up to $1.1 million.

The suggestions for how to avoid breaching the *Trade Practices Act* from the ACCC are (31):

- Think about the **message** that will be taken away by your target audience when producing your advertising. Even if you have the best of intentions, if your claims are misleading you could still be at risk of breaching the Act;
- Provide accurate and complete information to consumers on which to base their purchasing decisions. Misleading conduct can include **silence**. It is essential that your consumers have the full picture;
- **Clarify** your carbon claims. There are many varied standards of measurement, accounting and accreditation, so when making claims based on these, be sure to explain to consumers what you refer to and where to find further information;
- When making claims of **carbon neutrality**, spell out exactly what is included in your claim to avoid misleading consumers. Be aware that there is no universal definition of carbon neutrality and that consumer understanding of the term may vary; and
- If you are making statements as to the future, ensure you have a **reasonable basis** for making them. Think about how you would answer a query about your future statement and on what basis you made it.

CARBON OFFSETS

Much of the media attention on carbon related claims has focused on the quality of the carbon offsets available. Currently there is no mandated standard regarding carbon offsets in Australia, but there are numerous voluntary standards.

The Carbon Offset Guide[1] was set-up in 2007 by a partnership between EPA Victoria and RMIT University and provides an independent directory of Australian carbon offset providers. The aim of the project is to improve

[1] http://www.carbonoffsetguide.com.au/

the understanding of the offset market by Australian businesses, as well as the broader community, and facilitate better environmental and economic outcomes.

Some factors to consider when selecting appropriate offsets include (31):

1. **Additionality**

The most difficult part of ensuring the quality of carbon offsets is proving additionality. That is that the reduction in greenhouse gas emissions is additional to what would have occurred anyway. For example, a routine upgrade of equipment or changes in response to a regulatory requirement cannot be regarded as additional.

2. **Timing and forward credited offsets**

Some projects, for example forestry, can take a long time to result in greenhouse gases being removed from the atmosphere, and may not actually eventuate. These risks and how they are managed should be considered when purchasing offsets.

3. **Double counted offsets**

This occurs when an offset is sold to two or more parties by not "retiring" the offset after the initial sale. Look for offsets where the ownership of the credits is legally transferred.

4. **Permanence and risk management**

An emissions reduction project, for example forestry, may involve a number of risks that could impact the amount of carbon stored, such as fire, drought or pests. The offset company should have systems to monitor and account for changes in the amount of carbon stored.

5. **Co-benefits**

Co-benefits of a project can be important, for example biodiversity and habitat in forestry projects, but these should not be at the expense of the quality of the carbon offset.

6. **Accreditation**

The offsets should be accredited by a reputable body, and this information should be communicated to the consumers if possible.

CASE STUDY: Action by the ACCC

In June 2008, the Australian Competition and Consumer Commission (ACCC) demanded that tyre manufacturer Goodyear compensate consumers after finding that their claims that the Eagle LS2000 product was eco-friendly and cut carbon emissions were unsubstantiated (49).

In 2007, Origin agreed to withdraw television advertisements showing a spider living in the exhaust pipe of a retired car, an attempt to illustrate its claim that joining its GreenPower scheme was equivalent, in greenhouse gas emission terms, to not driving for two years. The ACCC said the advertisements could mislead because they did not differentiate between the 20% and 100% GreenPower deals (50).

In a case involving Energy Australia, the quality of carbon offsets were questioned. EnergyAustralia said it could "guarantee" its green power came from "100% renewable sources", but the sources were not accredited offset providers under any existing scheme (51).

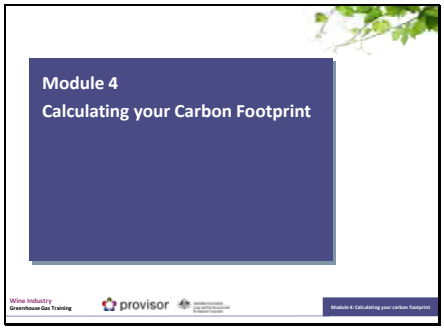
The court case against car manufacturer Saab over inflated green claims is currently ongoing.

The consumer magazine, Choice, recently completed an investigation into green beers, including Cascade Green, Barefoot Radler and Coopers. Their investigation found that although Coopers had undertaken a number of environmental projects, their claims of "Australia's Greenest Beer" could not be substantiated and have referred the case to the ACCC. (43)

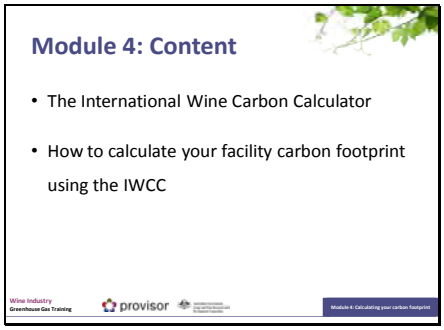
Module 4

Calculating your Carbon Footprint

Slide 1



Slide 2



Slide 3



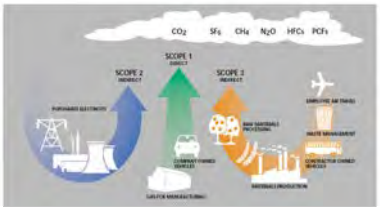
Slide 4

The International Wine Carbon Calculator - Scope

- Is intended to be used from a whole of company, or enterprise perspective
- Can be used equally effectively to gain an understanding of the carbon footprint of a company or of a facility
- Not intended to perfectly model emissions from the product perspective, although work has been done to ensure that it sets the framework for such calculations

Slide 5

Scope Diagram



Slide 6

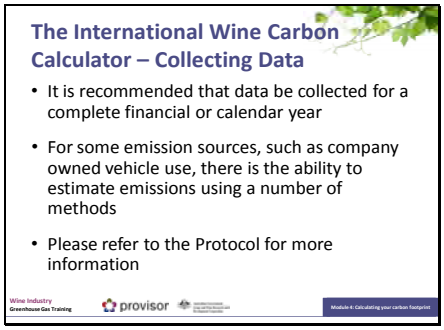
The International Wine Carbon Calculator - Scope

- Scope 1
  - Mobile equipment (fuel quantity consumed or distance travelled)
  - Stationary combustion
  - Synthetic gas fugitive emissions
  - Winemaking practices
  - Vineyard practices
  - Solid and liquid waste disposal
- Scope 2 purchased electricity

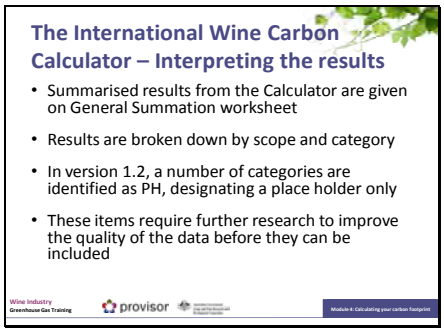
Slide 7



Slide 8



Slide 9



Slide 10



video

Slide 11



INTERNATIONAL WINE CARBON CALCULATOR V1.2

SCOPE

Provisor Pty Ltd was contracted by several national agencies – The Wine Institute of California, New Zealand Winegrowers, Integrated Production of Wine South Africa and the Winemakers Federation of Australia – to develop the International Wine Carbon Protocol (IWCP) and Calculator (IWCC) in 2007. The latest revision is version 1.2, released in July 2008.

The development of a carbon accounting protocol for the international wine industry was based on the methodology outlined by the World Resources Institute and the World Business Council for Sustainable Development in their Greenhouse Gas Protocol. Other reference material was also extensively consulted, including the International Standard, ISO 14064 1-3: 2006, for greenhouse gas accounting.

The IWCP is intended to be used from a whole of company, or enterprise perspective. It can be used equally effectively to gain an understanding of the carbon footprint of a company or of a facility. It is not intended to perfectly model emissions from the product perspective, although work has been done to ensure that it sets the framework for such calculations. The emission sources and sinks have been chosen to estimate the total greenhouse gas emissions of a vineyard, winery and bottling centre as accurately as possible with the currently available scientific data.

The Calculator's main focus is direct, that is Scope 1 and Scope 2 emissions from activities over which the organisation has operational control. The option to include significant indirect, that is Scope 3, emissions is also available. However, the detail of Scope 3 emissions is not sufficient to be used for a product life cycle assessment.

EMISSIONS SOURCES INCLUDED

The calculator has the ability to calculate greenhouse gas emissions from the following sources:

- Scope 1
  - Mobile equipment (fuel quantity consumed or distance travelled)
  - Stationary combustion
  - Synthetic gas fugitive emissions
  - Winemaking practices
  - Vineyard practices
  - Solid and liquid waste disposal
- Scope 2 purchased electricity
- Scope 3
  - Packaging manufacturing
    - Bottles and containers
    - Wine bags
    - Closures
    - Fibre packaging
    - Wooden products
  - Contract machinery use
  - Product transport (distance travelled or tonne.km methods)
  - Purchased wine related products
  - Solid and liquid waste disposal

COLLECTING DATA

It is recommended that data be collected for a complete financial or calendar year. If data is not available for the whole period, the data can be scaled to estimate the whole period, but will introduce additional uncertainty.

For some emission sources, such as company owned vehicle use, emissions can be estimated using a number of methods. Methods that use the actual fuel quantity consumed are considered more accurate. The emission factors used for each calculation have been assigned an uncertainty ranking in the Calculator that can also be used to choose between methods. Please refer to the Protocol for more information.

USING THE CALCULATOR

The Calculator is a protected Excel workbook that includes macro functionality. When opening the Calculator select 'enable macros' and 'don't update'. Your computer security setting will need to be set to low or medium to allow the required macros to run.

The cells on each worksheet have been colour coded to assist data entry:

- Cells shaded green are user entry cells. Users are able to enter numerical values or comments into these cells;
- Cells shaded with a pale pink are user choice cells. Users are requested to click on the cell and then select a choice from the drop down list; and
- Within the calculation sheet all cells that are not user entry cells or user choice cells are protected to ensure that formulas and values are not accidentally changed or modified. Users who wish to understand the calculation methodology or emission factors are encouraged to consult the appropriate sections of this report. Member companies of the Winemakers' Federation of Australia are able to contact the Federation to obtain password access to the calculator if it will assist the company with carbon footprint work being undertaken by the company or its consultants.

The worksheet tabs have also been colour coded:

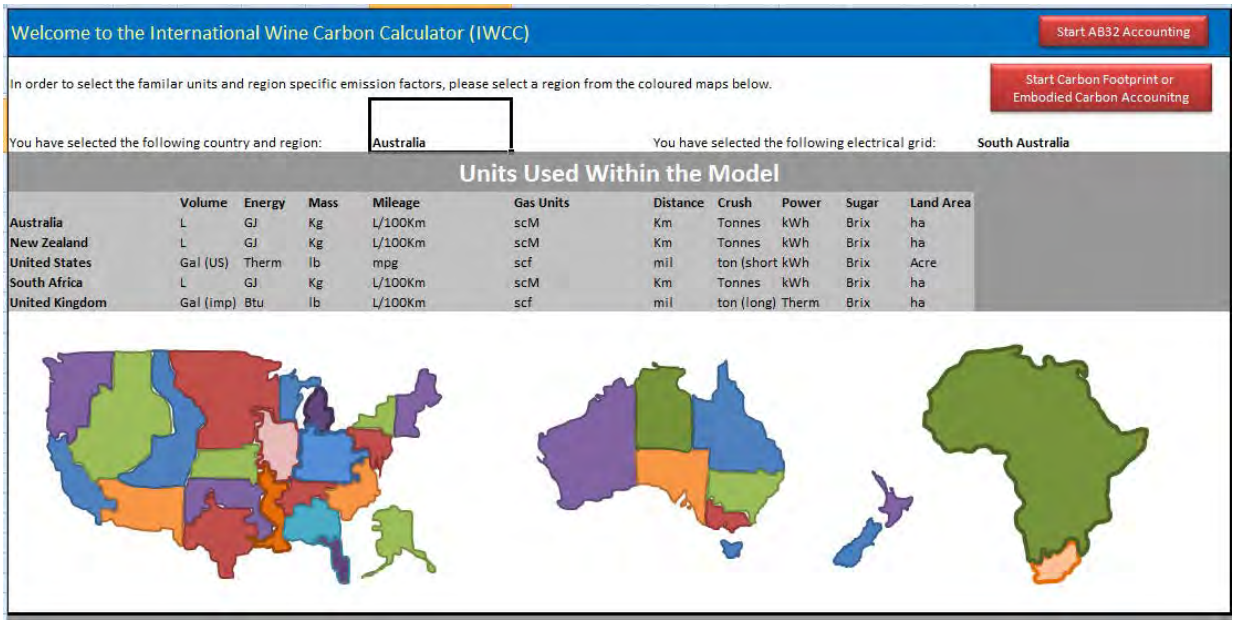
- Yellow tabs are part of the introduction and summary;
- Blue indicates that the calculations are part of Scope 1;
- Red indicates the calculations are part of Scope 2; and
- Green indicates calculations are part of Scope 3.

All calculator pages have red movement buttons in the top right hand corner of the page. The buttons can be used to move 'forward' or 'backward'. Users are encouraged to use these 'forward' and 'backward' buttons to move through the calculator.

The calculator is designed to be used to estimate the emissions for one reporting unit, for example one facility or one company. Separate copies of the calculator can be used to estimate emissions from multiple facilities.

A summary of each worksheet in the model is described below.

Figure 19 – IWCC V1.2 Introduction worksheet



INTRODUCTION

The purpose of the introduction worksheet is to identify the region and country of a user. Regions are based upon electrical supply grids and are not necessarily state/country based. Users are asked to click upon the particular geographical area in which their company operates. For example a South Australian winery would click on the orange region on the Australian map. The user is then identified by region and electrical supply grid.

Units of measure are automatically set to represent those specific to the region in which the user's company is based. For example, as Australia was selected in the previous example, liquid volume will now be represented in litres throughout the calculator. Scope 2 emission factors are related to electricity and are highly dependent upon the region's electrical grid. Scope 2 emission factors are set when the user clicks on the map.

After selecting the region in which their company operates the user is then encouraged to click on the red button in the top right hand corner which says "move to next page." This will take the user to the worksheet titled Mobile Equipment – Fuel Quantity Based Scope 1.

SCOPE 1 FUEL QUANTITY CONSUMED

This is a Scope 1 entry worksheet that relates to all mobile equipment defined as part of Scope 1 within the protocol. Users are only to enter information relating to their Scope 1 emissions. In order to operate this calculation worksheet, users will need to collect all Scope 1 fuel documents from within their company and categorise them by type. For example, if the only Gasoline/Petrol use within your company is in fleet cars, and you have four of them that consume 3,500, 2,500, 6,000 and 9,000 litres, then you would enter the sum of these four, 21,000 into cell C27. You may wish to add a comment to cell B27 to remind you what that the fuel use was for. Users need to ensure that all mobile operating equipment defined as Scope 1 within the protocol has been accounted for.

Where possible users are encouraged to enter their mobile equipment within the fuel quantity consumed section. However, if users do not have quantity based records, an emission approximation can be made using the distance based calculation method.

If users have information relating to the distance travelled by their Scope 1 vehicles but not the quantity of fuel consumed, then they are encouraged to click on the red button in the top left hand corner of the calculation

worksheet, to be directed to the distance based mobile fuels calculation worksheet. Users who do not wish to enter distance based information can move directly to the Stationary Combustion worksheet by clicking on the appropriate red button in the top right hand corner.

SCOPE 1 DISTANCE TRAVELLED

Occasionally organisations may not have complete records kept to indicate the volume of fuel consumed in their Scope 1 mobile operating equipment. In some cases it may be possible to estimate emissions by understanding the distance travelled. This might come in the form of odometer readings or log book records.

It is critical to ensure that companies that adopt this method and the quantity based method at the same time do not double count emissions sources. There must be a clear accounting principle to differentiate between the quantity based method and the distance travelled method.

In order to use this section of the calculator, users need to ensure that they are on the Mobile Equipment – Distance Based worksheet. It is thought that this method will generally be used for cars, rather than plant related equipment such as forklifts and tractors. The pink cells are user choice cells. The user can select the type of car used by clicking on the drop down button. The units should be correct and familiar to the user as they were selected at the introduction worksheet.

In Column D users are encouraged to enter the distance travelled against an appropriate description of the vehicle in question. Next, the type of travel is selected, either city or highway, this can be done by using the drop down buttons in Column E. In most cases city travel should be selected to ensure emissions are not under estimated. A list of cars is contained within the pink cells, C21 to C26. Users should be able to find their exact car or a very close approximation to their car.

SCOPE 1 STATIONARY COMBUSTION

Stationary combustion, as defined in the Protocol, is all combustion related activities that occur in fixed items. Examples in the wine industry include hot water heaters, boilers and generators. Users are encouraged to collect documentation detailing the quantity of fuel used by stationary combustion equipment. The fuel use needs to be categorised and summed by fuel type.

Users enter the quantity of fuel used in the combustion device in Column C against the appropriate fuel type. For example, if your operation has 1 boiler and 1 generator that each consume 5,000 litres of diesel per annum, you would enter 10,000 into cell C31. You might like to add a comment into cell B31 along the lines of “Boiler and Generator.”

All fuels used within onsite stationary combustion devices must be accounted for within this section of the model.



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SCOPE 1 FUGITIVE EMISSIONS



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Fugitive emissions are defined as emissions of greenhouse gases that arise from leaks or spills. In the case of the wine industry, sources of synthetic gas emissions such as refrigeration equipment and gas insulated electrical switch gear are included. Natural and LP gas combustion devices are also known to emit fugitive emissions, for example from poor pipe work connections. However, fugitive emissions from gas use are included in the emission factors for the fuel use in stationary combustion.

Two methods are available for users to calculate their fugitive emissions from synthetic gas use. In both cases users will need to identify the type of gas used within their equipment.

1. **Recharge Weight**

   Emissions can be quantified by using the annual recharge weight (from service documents) of refrigeration gases. If annual service documents can be traced that show the recharge weight of gas, then users are encouraged to adopt this value rather than the default loss method. The pink cells in Column B are user choice cells; users can select the type of gas within their equipment. Column C is a green user input column; users are encouraged to enter the annual recharge weight of gas from service documents into this column.

2. **Default Fugitive Losses**

   If service documents are not available or do not show the annual recharge weight, then the default loss rate method should be adopted. Users will need to know the total gas weight within their device. This information should be available in the equipment specification documents.

SCOPE 1 WINEMAKING PRACTICES

The direct CO_2 that is purchased and used in winemaking is included in the reporting totals, and is entered under winemaking practices.

Although part of the short-term carbon cycle, and therefore not included in reporting totals, understanding the CO_2 produced from fermentation in the winemaking process is included as an optional feature of the calculator.

To calculate fermentation emissions, users are required to enter:

- Volume of fruit;
- Typical press extraction;
- Extra juice added to the ferment;
- Average baume;
- Residual sugar in the finished wine; and
- Amount of malic acid converted to lactic acid.

The process has been divided into white, red, sparkling and fortified product. All user entry cells have been coloured green. There is space to include comments in Column H.

SCOPE 1 BIOMASS PHOTOSYNTHESIS

Biomass photosynthesis is also considered part of the short-term carbon cycle, but is included within the calculator to give a better understanding of emission and sink sources within the industry. Users can enter the harvest size of their red, white, sparkling and fortified dedicated fruit. An average baume of this fruit is also requested in order to calculate the total sugar content. Comments can be entered in Column I.



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SCOPE 1 VINEYARD PRACTICES

The vineyard practices worksheet has three areas that require user information. The first section is concerned with nitrous oxide emissions from fertiliser or nitrogen addition. Fertilisers include any soil additions that contain nitrogen, including both organic (natural) and inorganic (synthetic) fertilizers. Users are requested to enter the amount of fertiliser into Column B and the percent nitrogen content by mass of the fertiliser in Column F. Comments can be added in Column A.

The emission factor used to calculate nitrous oxide emissions has been derived for the purposes of international accounting, and may not be accurate when applied at the vineyard level due to various environmental factors and management practices.

The second section of this calculation worksheet is concerned with nitrous oxide emissions that result from soil cultivation. There is a high degree of uncertainty with this data, and it is included as a placeholder only. Users can enter the vineyard area that is cultivated to estimate emissions

The third section of this worksheet is concerned with vineyard soil carbon content changes with permanent row cropping. There is also a high degree of uncertainty with this data, and it is included as a place holder only. Users can enter the land area of their vineyard that is under permanent row cropping to estimate emissions.

SCOPE 1 WASTE DISPOSAL

Waste disposal is only categorised as part of Scope 1 if the treatment or disposal occurs within the operating boundary. This calculation worksheet has been developed for estimating methane emissions from both solid and liquid waste treatment.

Initially users are prompted to enter their solid waste disposal requirements. Users are requested to select the type of waste from the drop down list in Column B. The weight of waste is then to be entered into Column C. A comment can be added to Column A. Users have space to account for various types of solid wastes, with each row to be used for a different type or category of waste.

After completing the solid waste section, users complete the waste water section. Users need to understand the following factors involved in their waste water streams:

- Volume of waste water;
- Source of waste water;
- COD (mg/L) of their waste water; and
- How much, if any, methane is recovered within the treatment of that waste water (please note that if methane is flared within the waste treatment site, this is comparable with recovery from a greenhouse gas perspective).

SCOPE 2 PURCHASED ELECTRICITY

Scope 2 purchased electricity is clearly defined within the IWCP. It relates to all purchased electricity.

As a minimum, users need to enter their annual electricity consumption into Column D. More than one row has been provided for users to separate their electricity consumption as most appropriate. Comments and facility or source information can be added to Columns C and A respectively.

SCOPE 3 PACKAGING

Packaging is a complex area to model. There are many subtleties that influence the overall accuracy of the calculations, but emission factors have been simplified in this model to give an order of magnitude estimate of emissions.

The use of this calculation worksheet is relatively straight-forward. Users are required to enter the number of units used in Column D and the average weight of those units into Column E. Comments can be made in Column C.



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In some cases users may have to calculate their individual unit requirements from bulk information on packaging products. Information has been displayed on a unit basis to allow for easy comparison between different packaging options.

SCOPE 3 CONTRACT MACHINERY

This worksheet is designed to calculate emissions that arise from the use of contract machinery. Two broad categories have been considered; helicopters for frost fighting and tractor or tractor like vineyard equipment including harvesters.

In order to estimate the emissions from the use of helicopters, users are prompted for the helicopter size. This can be changed by using the drop down list in Column C. The number of hours the helicopter was used for is entered into Column D.

Tractor emissions can be calculated in two ways. Users can select either, a large or small tractor, from the user choice cells C20 and C21, or enter the PTO horsepower rating of the equipment. The number of hours the tractors operate is entered into Column D. The fuel type is then selected from Column E.



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SCOPE 3 TRANSPORT

The Scope 3 transport calculation worksheet is the most involved and complex worksheet of this version of the calculator.

Road transport emissions can be calculated using a distance travelled method or a freight-weight transported method (tonne.km method). The distance travelled method is more complex, but can give more accurate emissions estimates.

If using the distance travelled method, users will need to know the total distance travelled, summing each individual trip and deciding if the return journey should also be included. Users then enter the total distance travelled for each transport mode into Column C, and also choose the type of travel in Column D.

Transport emissions can also be estimated using only the freight weight and total distance travelled, also called the tonne.km method. This option is available for road, air, rail, and sea based transport and is recommended for comparing different transport modes. Users enter the total freight weight in Column C and the total distance in Column D.

SCOPE 3 PURCHASED WINE PRODUCTS

This worksheet can estimate the greenhouse gas emissions from the production of items commonly used in the making of wine. There is a high degree of uncertainty with this data, and it is included as a place holder only. Users can select the purchased product from the drop down lists in Column B. The quantity of product is then entered into Column C. A description can be added to Column A.

SCOPE 3 WASTE DISPOSAL

Waste disposal is only categorised as part of Scope 3 if the disposal occurs on premises not under the user's control. Examples include Government controlled landfill sites and municipal waste water treatments sites.

Initially users are prompted to enter their solid waste disposal requirements. Users are requested to select the type of waste from the drop down list in Column B. The weight of waste is then to be entered into Column C. A comment can be added to Column A. Users have space to account for various types of solid wastes. Each row is to be used for a different type or category of waste.

After completing the solid waste section users are required to complete the waste water section. Users need to understand the following factors involved in their waste water streams:

- Volume of waste water;
- Source of waste water;
- COD (mg/L) of their waste water; and
- How much, if any, methane is recovered (including flaring) within the treatment of that waste water.

INTERPRETING RESULTS

Summarised results from the Calculator are given on the General Summation worksheet, broken down by Scope and category. In version 1.2, a number of categories are identified as PH, designating a place holder only. These items require further research to improve the quality of the data before they can be included.

Further information can be gained from the data by dividing by the annual production in litres to give the amount of greenhouse gas emissions per litre of wine. Results may be compared to previous year's data to highlight trends. Further information on typical ranges of greenhouse gas emissions from wine production can be found on page 119.

The protocol has been designed to ensure uniform inclusions of Scope 1 and Scope 2 emissions sources, and comparisons could also be made across facilities or organisations if the results are made available. However, caution should be exercised when comparing Scope 3 emissions, as some judgement is required about where to draw the boundary for inclusion of emissions sources. If Scope 3 emissions are to be compared, users should first compare the boundaries that were chosen for the investigation.

GREENHOUSE GAS LIFE CYCLE ASSESSMENT (PRODUCT EMBEDDED CARBON)

As discussed in Chapter 2, the scope, including system boundary and level of detail, of an LCA can differ considerably depending on the subject and the intended use of the study. Completing a product life cycle assessment can be a complex and labour intensive task, and specialised training in LCA techniques is usually required.

It is outside the scope of this manual to provide the training required to complete an LCA. Instead, this section will focus on the areas to consider when commissioning an LCA.

In completing an LCA, three critical areas that need to be addressed to ensure success are:

- A clear description of the reason for completing an LCA;
- A clear definition of the way the results of the LCA are to be communicated internally and externally; and
- A resource allocation that may include funding and/or staff time.

An LCA study consists of four steps:

1. Defining the goal and scope of the study;
2. Making a model of the product life cycle with all the environmental inflows and outflows. This data collection effort is usually referred to as the life cycle inventory (LCI) stage;
3. Understanding the environmental relevance of all the inflows and outflows; this is referred to as the life cycle impact assessment (LCIA) phase. For a full LCA, possible impact categories to assess damages include climate change (greenhouse gases), acidification, smog, ozone layer depletion, eutrophication, eco-toxicological and human-toxicological pollutants, desertification, land use as well as depletion of minerals and fossil fuels; and
4. The interpretation of the study. This can be difficult if looking at multiple impact categories, but is simplified if only considering greenhouse gases.

PROCESSES ACCORDING TO ISO14040

The ISO standards are defined in a quite vague language, which makes it difficult to see if an LCA has been made according to the standard. Unlike the 14000 standard, it is not possible to get an official certification that states that an LCA has been made according to the ISO standard.

DEFINING GOAL AND SCOPE



The most important part of aiming to adhere to the ISO standard is the need for careful documentation of goal, scope and interpretation issues. Generally, the person commissioning the study will work with the person or team completing the study to define the goal and scope.

The reason for executing the LCA and the questions which need to be answered must be described. This includes the intended audience. For example, a study that produces results that will be used internally is quite different to one that will be released publically. Furthermore, the ISO standard requires that when public comparisons are made between two or more products, a critical review is required,

preferably by an independent external expert.

A description of the system boundaries for the study should also be included in the scope. Most product systems tend to be interrelated in a very complex way. To illustrate, in an LCA on producing wine, trucks are used. However, trucks are also products with a life cycle. To produce a truck, steel is needed, to produce steel, coal is needed, to produce coal, trucks are needed, and so on. Clearly, the life cycle cannot be traced back indefinitely, so a system boundary must be drawn. If this is not drawn correctly, the results can be distorted.

Other items to be addressed include:

- Assumptions and limitations;
- The intended audiences and the way the results will be communicated;
- If applicable, details of an external or peer review process; and
- The type and format of the report required for the study.

INVENTORY ANALYSIS (COLLECTING DATA)

In life cycle assessment, there are two main types of data that are defined:

1. **Primary data**
   This is the quantitative measurement of activity from a product's supply chain. Examples of greenhouse gas activity data include the amount of energy, fuels or electricity consumed, material produced, service provided or area of land affected. Primary activity data sources are typically preferable to secondary data sources as the data will reflect the specific nature/efficiency of the process, and the greenhouse gas emissions associated with the process.

2. **Secondary data**
   This is data obtained from sources other than direct measurement of the processes included in the lifecycle of the product. This is generally used for generic materials and processes that are not a major emissions source.

IMPACT ASSESSMENT

The impact assessment is relatively straight forward when only considering greenhouse gas emissions. The method involves converting all greenhouse gas emissions to tonnes of carbon dioxide equivalent using the global warming potentials defined by the Intergovernmental Panel on Climate Change.

The impact assessment should include a sensitivity analysis, i.e. how the results vary depending on choices and assumptions made, and an uncertainty analysis, i.e. what is the statistical error in the final result due to statistical error in the input data. In practice, calculating uncertainty values requires specialised software packages.

INTERPRETATION

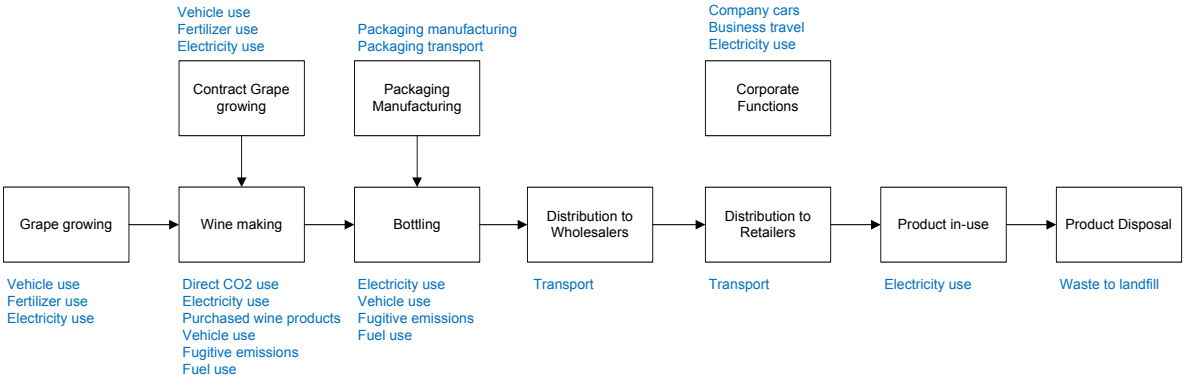
Again, interpretation is relatively straight-forward when only considering greenhouse gas emissions. Comparisons with industry averages may be made where data is available.

TYPICAL SUPPLY CHAIN EXAMPLE

Although each product life cycle assessment will be different, a simplified example of a typical supply chain to consider for bottled table wine is shown in Figure 20. For each stage, some of the emissions sources that should be considered are listed. In reality, the stages shown represent a number of separate stages that will be

required to be modelled individually. For example, depending on the market, distribution to wholesales could include road transport to a rail station, rail transport to a port, shipping internationally and road transport to the wholesale warehouse. Data will need to be collected on each stage to allow the emissions to be allocated to the functional unit, usually one litre or one bottle of wine.

Figure 20 – Example of supply chain and emissions sources for a winery



PRIMARY DATA

Collecting primary data requires direct measurements of inputs from across the supply chain. For a product LCA, this may include collecting data from people outside your own company, such as main raw material suppliers. Care should be taken to note all relevant details such as the time period covered, the detail of what is included and what is excluded, units of the data, and any other assumptions made.

For processes that produce multiple products, for example a useful product and a waste product, a decision on how to allocate the emissions across products needs to be made. Common allocation methods include mass allocation, where a percentage of the emissions are allocated to each product based on the mass, and economic allocation, where a percentage of the emissions are allocated to each product based on the value. For a process that also produces a waste product, economic allocation is often used, as it ensures that all of the emissions are allocated to useful products.

SECONDARY DATA

There are numerous sources of data for the generic materials and processes that are not a major emissions source in the LCA. These include:

- Published literature on previous studies, such as journal articles;
- Commercial LCA databases, such as the Swiss Ecoinvent database; and
- Data from industry groups

Care should be taken when using secondary data. It must be assessed to ensure the data is in line with the requirements defined in the goal and scope. An approach that is often taken is to use secondary data initially to identify the main emissions sources, and then conduct further investigation to improve the quality of this data.

COMPARISONS AND PEER REVIEW

As previously mentioned, where the results of an LCA are intended to be used to compare products and disclosed to the public, ISO 14044 specifies that a critical peer review must be conducted. This is in order to decrease the likelihood of misunderstandings or negative effects on external interested parties.

The purpose of a critical peer review is to ensure that:

- The methods used to carry out the LCA are consistent with the relevant standard, such as ISO 14040;
- The methods used to carry out the LCA are scientifically and technically valid;
- The data used are appropriate and reasonable in relation to the goal of the study;
- The interpretations reflect the limitations identified and the goal of the study; and
- The study report is transparent and consistent.

The review could be completed by an individual expert in LCA, or a panel, and could be made up of people internal or external to the company. The most important part is that they were not involved in conducting the LCA.

WINERY BENCHMARKING OF CARBON

The greenhouse gas emissions from a particular facility, or embedded in a product will vary with many factors, such as irrigation requirements, size of facility, packaging materials, distribution markets etc. However, the following information is meant to act as a rough guide for companies compiling greenhouse gas inventories.

For **vineyard** operations in Australia, total Scope 1 and Scope 2 greenhouse gas emissions are typically in the range 0.1-1 kg CO_2-e/L wine. The main variables are the amount of electricity used for running irrigation systems and the number of vehicle passes per row.

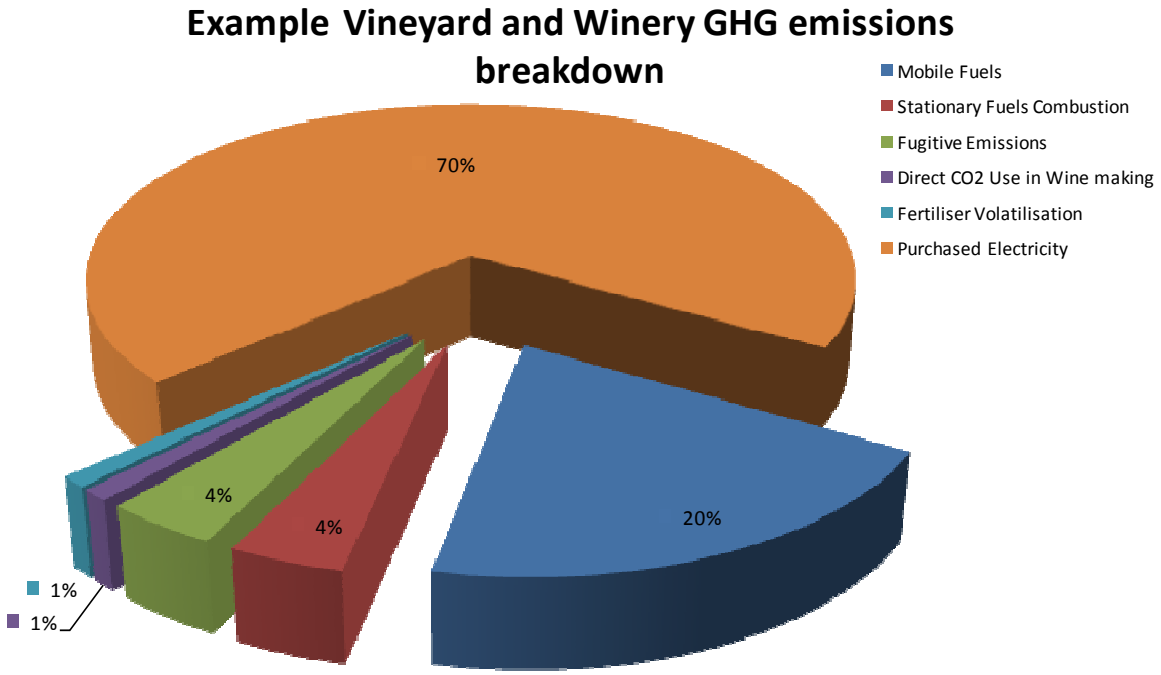
For **winery and bottling** operations in Australia and New Zealand, total Scope 1 and Scope 2 greenhouse gas emissions are typically in the range 0.3-1 kg CO_2-e/L wine. The main variable is the amount of electricity used, which in turn depends on type of equipment, efficiency and use of refrigeration plant etc.

An example breakdown of Scope 1 and 2 emissions from integrated vineyard and winery using electricity from the South Australia grid is shown in Figure 21.

This would include:

- Mobile equipment emissions in the vineyard and winery;
- Synthetic fertiliser application emissions in the vineyard;
- Fugitive emissions from the winery;
- Direct CO_2 use in winemaking;
- Stationary fuel combustion emissions from the winery; and
- Electricity use for irrigation, winery and wastewater treatment plant operations.

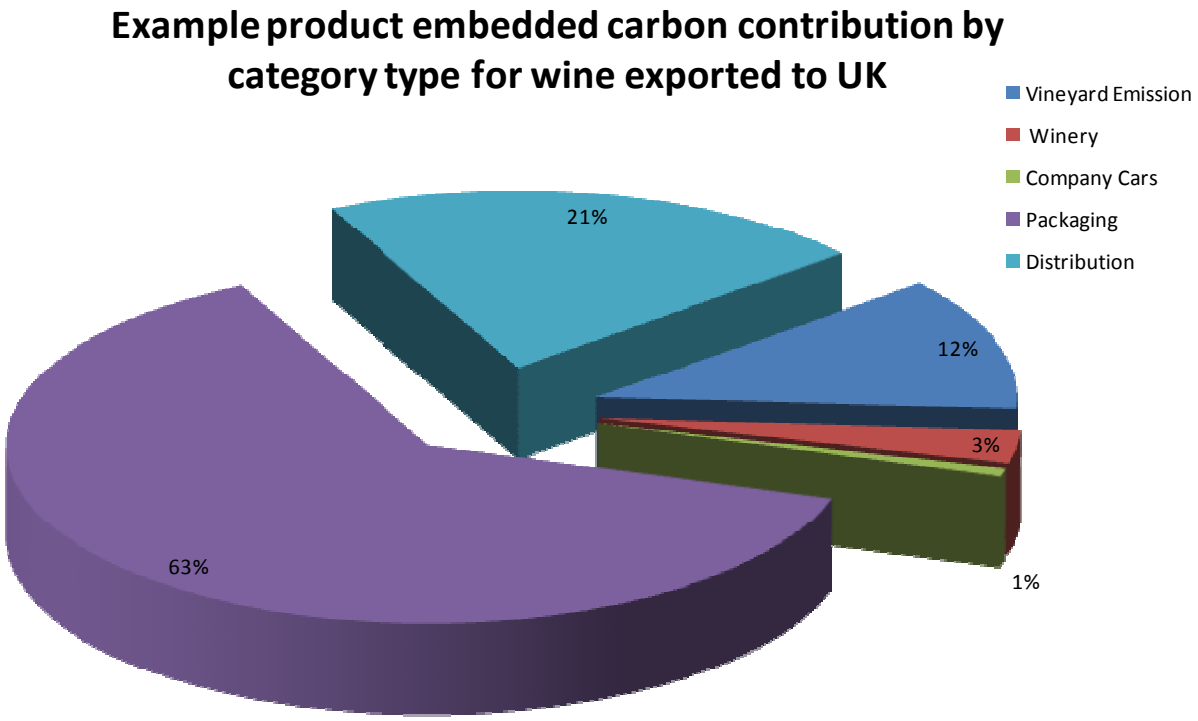
Figure 21 – Example Scope 1 and Scope 2 greenhouse gas emissions breakdown for integrated vineyard and winery



An example of the contribution to a product embedded carbon calculation by category for a wine exported to the UK is shown in Figure 22.

The majority of emissions are from manufacture of the glass bottles for packaging, followed by transport of the finished product to the UK by ship.

Figure 22 – Example product embedded carbon contribution by category type for wine exported to UK



HIGH LEVEL REDUCTION STRATEGIES

This document is focused on understanding and measuring greenhouse gas emissions in the wine industry, but a brief introduction to reduction strategies will be given here.

In the winery, the major source of emissions (depending on the electricity grid) is usually Scope 2 emissions from the generation of purchased electricity. Electricity can also be a major source of emissions in an irrigated vineyard. Further investigation is usually required to determine the major uses of electricity, and commissioning an Energy Audit according to Australian Standard AS/NZS 3598:2000 can be helpful.



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For a product embedded carbon calculation, manufacture of the glass bottle can typically account for around 50% of the total emissions. The obvious reduction strategy is to pursue a reduction in the weight of the glass bottle, which can lead to cost and emissions reduction.

Related to the weight of the glass bottle, is the level of emissions from transporting the finished product. A glass bottle is typically around 25% of the total product mass (including all packaging), and when shipped long distances, such as to the UK, can contribute a significant amount to the product emissions. Again, emission reduction strategies can include focusing on reducing the weight of the packaging material.

TYPICAL EFFORT REQUIRED TO COMPLETE CARBON MANAGEMENT PROJECTS

To assist planning, this section contains some estimates of the time required to complete carbon management projects. It is assumed that the work is being conducted by employees familiar with the tools and techniques, and does not include training time (this is especially relevant for LCA work).

For facility level greenhouse gas calculations, approximately 3 weeks work is usually required.

This includes data collection, which is often the most time consuming step when using the IWCC.

For an LCA completed for internal purposes only, approximately 3-6 weeks is required. For an LCA intended to be released externally (i.e. including a peer review process), upwards of 10 weeks can be required.

Online reference material for module 3 and 4

Department of Climate Change http://www.climatechange.gov.au/index.html

Australian Competition and Consumer Association http://www.accc.gov.au/content/index.phtml/itemId/815214

Greenhouse Friendly http://www.climatechange.gov.au/greenhousefriendly/index.html

Winemakers' Federation of Australia and IWCC http://www.wfa.org.au/environment.htm

BIBLIOGRAPHY

1. **Intergovernmental Panel on Climate Change.** *Climate Change 2007: Synthesis Report.* s.l. : IPCC, 2007.

2. **National Snow and Ice Data Center.** Arctic Sea Ice Down to Second-Lowest Extent; Likely Record-Low Volume. *Natiional Snow and Ice Data Center.* [Online] 2 October 2008. [Cited: 7 October 2008.] http://nsidc.org/news/press/20081002_seaice_pressrelease.html.

3. **Derocher et al.** Polar Bears in a Warming Climate. *Integrative and Comparative Biology 44(2):163-176.*

4. **National Snow and Ice Data Centre.** Artic Sea Ice News and Analysis. [Online] 2008. [Cited: 2 September 2008.] http://nsidc.org/news/press/2007_seaiceminimum/images/20071001_extent.png.

5. **CSIRO Division of Atmospheric Research.** *Climate Change Projections for the Australian Region.* s.l. : CSIRO, 2001.

6. **Church, J.A., Hunter, J.R. McInnes, K.L. and White, N.J.** Sea-level rise around the Australian coastline and the changing frequency of extreme sea-level events. *Aust. Meteorol. Mag.* 2006, 55, pp. 253-260.

7. Scientists: Natural Disasters Becoming More Common. *Live Science.* [Online] 17 October 2005. [Cited: 15 October 2008.] http://www.livescience.com/environment/051017_natural_ disasters.html.

8. **Murphy BF, Timbal B .** A review of recent climate variability and climate change in southeastern Australia. *International Journal of Climatology 28, 859-879.* 2008.

9. **National Climate Centre, Bureau of Meteorology.** *Annual Climate Summary 2007.* Melbourne : Commonwealth of Australia 2008, 2008.

10. **Garnaut, Ross.** *The Garnaut Climate Change Review - Final Report.* s.l. : Cambridge University Press.

11. **Cai W, Cowan T.** Evidence of impacts from rising temperature on inflows to the Murray-Darling Basin. *Geophysical Research Letters 35, L07701.* 2008.

12. **Bureau of Meteorology .** Timeseries - Australian Climate Variability and Change. *Bureau of Meteorology .* [Online] [Cited: 7 October 2008.] http://www.bom.gov.au/cgi-bin/silo/reg/cli_chg/timeseries.cgi?variable=tmean&region=aus&season=0112.

13. Yearly Streamflow for Major Surface Water Sources. *Water Corporation .* [Online] [Cited: 10 September 2008.] http://www.watercorporation.com.au/_images/Dams/Dams_streamflow.gif.

14. **Garnaut Climate Change Review.** *Draft Report.* Canberra : Commonwealth of Australia, 2008. ISBN 978-1-921337-34-5.

15. **Garnaut Review.** *Targets and Trajectories: Supplementary Draft Report.* Canberra : Commonwealth of Australia, 2008. ISBN: 978-1-921337-42-0.

16. **Kay, Paul.** Terms and Impacts of the Kyoto Protocol . *Parliament of Australia.* [Online] Commonwealth of Australia, 9 March 1998. [Cited: 11 September 2008.] http://www.aph.gov.au/library/Pubs/cib/1997-98/98cib10.htm.

17. **Webb, Leanne B.** *The impact of projected greenhouse gas-induced climate change on the Australian wine industry.* s.l. : University of Melbourne, 2006. PhD Thesis.

18. **Webb L, Whetton P, Barlow EWR.** Climate change and wine grape quality in Australia. *Climate Research.* 2008, Vol. 36, pp. 99-111.

19. **Department of Climate Change.** Climate Change Science. *Department of Climate Change.* [Online] 2008. [Cited: 11 September 2008.] http://www.climatechange.gov.au/science/faq/question1.html.

20. **Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz and R. Van Dorland.** Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [ed.] S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller Solomon. s.l. : Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

21. **NASA Earth Science Enterprise.** Earth Observatory. *NASA.* [Online] http://earthobservatory.nasa.gov/Library/CarbonCycle/carbon_cycle4.html.

22. **Wikipedia.** Nitrogen Cycle. [Online] 2008. [Cited: 9 September 2008.] http://en.wikipedia.org/wiki/Nitrogen_cycle.

23. **Ugalde et al.** Implications of climate change for tillage practice in Australia. *Soil & Tillage Research.* 2007, Vol. 97.

24. **Wikipedia.** Carbon Footprint. *Wikipedia.* [Online] Wikimedia, 2008. [Cited: 2 September 2008.] http://en.wikipedia.org/wiki/Carbon_footprint.

25. **World Resources Institue and World Business Council for Sustainable Development.** *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard.* Washington, DC : World Resources Institue and World Business Council for Sustainable Development, 2004. ISBN 1-56973-568-9.

26. **New Zealand Business Council For Sustainable Development.** *The "why" and "how" of accounting and reporting for GHG emissions: An Industry Guide.* s.l. : New Zealand Business Council For Sustainable Development, 2002.

27. **Department of Climate Change.** *National Greenhouse Accounts (NGA) Factors.* Canberra : Department of Climate Change, 2008.

28. **Provisor.** *International Wine Carbon Calculator Version 1.2.* s.l. : FIVS, 2008.

29. **World Resources Institute.** ISO, WRI, and WBCSD Announce Cooperation on Greenhouse Gas Accounting and Verification. [Online] 3 December 2007. [Cited: 2 September 2008.] http://www.wri.org/press/2007/12/iso-wri-and-wbcsd-announce-cooperation-greenhouse-gas-accounting-and-verification.

30. **ISO.** *14040 Environmental management - Life cycle assessment - Requirements and guidelines.* Geneva : ISO, 2008.

31. **Australian Competition and Consumer Commission.** *Carbon Claims and the Trade Practices Act.* Canberra : Commonwealth of Australia, 2008. ISBN 978 1 921393 78 5.

32. **British Standards Institute.** *PAS2050:2008 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services.* London : British Standards Institute, 2008. ISBN 978 0 580 50978 0.

33. —. *Guide to PAS 2050: How to assess the carbon footprint of goods and services.* London : British Standards Institute, 2008.

34. **The Carbon Trust.** *Code of Good Practice for Product Greenhouse Gas Emissions and Reduction Claims: Guidance to support the robust communication of product carbon footprints.* London : The Carbon Trust, 2008.

35. **Walkers Snacks.** Walkers - reducing our carbon footprint. [Online] 2007. [Cited: 3 September 2007.] http://www.walkerscarbonfootprint.co.uk/.

36. **World Resources Institue and World Business Council for Sustainable Development.** Greenhouse Gas Protocol - Product and Supply Chain. [Online] [Cited: 2 September 2008.] http://www.ghgprotocol.org/standards/product-and-supply-chain-standard.

37. **Department of Climate Change.** *National Greenhouse and Energy Reporting Guidelines.* Canberra : Department of Climate Change, 2008. ISBN: 978-1-921298-23-3.

38. —. *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008 v1.0.* Canberra : Department of Climate Change, 2008. ISBN: 978-1-921298-24-0.

39. —. *Carbon Pollution Reduction Scheme Green Paper.* Canberra : Department of Climate Change, 2008. ISBN: 978–1–921298–25–7.

40. —. *National Greenhouse Gas Inventory 2006.* Canberra : Department of Climate Change, 2008. ISBN: 978-1-921298-10-3.

41. **Australian Greenhouse Office.** *Growing trees as greenhouse sinks: An overview for Landholders.* Canberra : Australian Greenhouse Office, Department of the Environment and Heritage, 2006. ISBN: 1 921120 78 9.

42. **TerraChoice Environmnetal Marketing Inc.** TerraChoice. *TerraChoice - The Six Sins.* [Online] November 2007. http://www.terrachoice.com/files/6_sins.pdf.

43. **Choice.** Green beers spread roots. [Online] July 2008. [Cited: 26 August 2008.] http://www.choice.com.au/viewArticle.aspx?id=106444&catId=100570&tid=100011.

44. **The Greenhouse Gas Protocol.** About the GHG Protocol. [Online] 2008. [Cited: 2 September 2008.] http://www.ghgprotocol.org/about-ghgp.

45. **Tesco.** Tesco, Carbon and the Consumer. [Online] 18 January 2007. [Cited: 2 September 2008.] http://www.tesco.com/climatechange/speech.asp.

46. **ABC News.** Big-business green marketing claims under fire. *ABC News.* [Online] 20 June 2008. [Cited: 27 Spetember 2008.] http://abc.com.au/news/stories/2008/06/20/2280890.htm.

47. **Fosters Group.** Cascade Green. [Online] 2008. [Cited: 27 September 2008.] http://www.cascadegreen.com.au/faqs.aspx.

48. **Winemakers' Federation of Australia.** WFA Environment. [Online] 11 August 2008. [Cited: 29 August 2008.] http://www.wfa.org.au/environment.htm.

49. **ACCC.** Goodyear Tyres apologises, offers compensation for unsubstantiated environmental claims. *ACCC.* [Online] 26 June 2008. http://www.accc.gov.au/content/index.phtml?itemId=833219.

50. —. ACCC scrutinises Origin green power television advertisement. *ACCC.* [Online] 21 September 2007. http://www.accc.gov.au/content/index.phtml/itemId/806645/fromItemId/621575.

51. —. EnergyAustralia clears air about green electricity claims. *ACCC.* [Online] 21 December 2007. http://www.accc.gov.au/content/index.phtml/itemId/806650/fromItemId/621575.

52. **National Climate Centre.** *An Exceptional and Prolonged Heatwave in Southern Australia.* s.l. : Bureau of Meteorology, Special Climate Statement 15, 2008.

53. **The Carbon Trust.** Consumers want businesses to act on climate change. [Online] 6 November 2006. [Cited: 3 September 2008.] http://www.carbontrust.co.uk/News/presscentre/2006/061106_consumers.htm.