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An Assessment of the Likely Impacts of Greenhouse Policy on the Red Meat Processing Industry

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EXECUTIVE SUMMARY

This report was commissioned by Meat and Livestock Australia (MLA) and the Australian Meat Processor Company (AMPC) to examine the potential impacts on the red meat processing sector of government policy responses to the enhanced greenhouse effect.

The report assesses the likely impacts of greenhouse policy on the sector and suggests strategies for individual meat processors and the industry as a whole to minimise potential costs and maximise potential benefits. It focuses on issues directly relevant to meat processing operators, including auxiliary operations such as feedlots. It also considers important 'upstream' emission sources but disregards related operations generally carried out by other companies such as hide and tallow processing.

Key findings of the study are:

1. *The scientific consensus is that an enhanced greenhouse effect is underway and international and national policies are being introduced to promote reductions in greenhouse gas emissions..*
2. *Australia has established a multi-faceted program to reduce its emissions and is investigating setting up a carbon emissions trading system.*
3. *Meat production gives rise to greenhouse gas emissions from a range of processes. Emissions are dominated by enteric methane (CH_4) from livestock.*
4. *Meat processors could face dramatic increases in the cost of livestock.*
5. *The livestock sector is a good candidate for initial exclusion from carbon trading but there is no chance of the industry being ignored by policy makers.*
6. *Greenhouse policy is likely to encourage a shift towards intensive production from less intensive and less efficient broad-acre operations.*
7. *Options are available for the sector to respond to the greenhouse challenge that will reduce the sector's liabilities.*
8. *Greenhouse policy could lead to:*
    - *a reduction in livestock production;*
    - *an increase in the price of complementary products such as wool, possibly resulting in reductions in herd numbers and further increasing livestock prices due to contracting supply;*
    - *a shift towards intensive production such as feedlots from less intensive and less efficient broad-acre operations (unless these are able to compensate for their emissions by producing carbon sinks);*
    - *a competitive disadvantage to Australian meat exporters in comparison to the large South American producers;*
    - *a shift from greenhouse intensive red meats to pork, chicken and non-meat alternatives; and*
    - *an overall contraction of the red meat production industry.*
9. *Best practice greenhouse management is consistent with good abattoir management. Best practice measures for meat processors include:*
    - *improving process energy efficiencies, particularly of electricity;*
    - *improving transport efficiency;*
    - *reducing anaerobic management of waste, or capturing biogas emissions for flaring or preferably energy recovery;*
    - *managing nitrogen rich wastewater and manures to reduce denitrification, which generates the powerful greenhouse gas nitrous oxide; and*
    - *reducing emissions from abattoir feedlots.*

10. It is the authors' view that due to complexity and political sensitivities, agricultural operations are likely to be initially exempt from compulsory participation in carbon trading systems but alternative policy measures will be applied to the sector.

11. The meat and livestock sector may be able to make a case to government to remaining excluded from carbon emissions trading systems until competitor nations' meat industries are including in trading systems. This case will be strengthened if the sector can demonstrate that it is achieving net reductions in total emissions and emissions per unit of product.

12. It is recommended that operators and the industry collectively should be proactive reducing its greenhouse gas emissions and preparing for increasingly demanding government greenhouse policies. This is considered to be the most effective approach for operators and the industry to minimise its greenhouse liabilities and maximise its leverage with policy makers.

13. It is recommended that individual meat processors:

- *Adopt best practice measures to reduce greenhouse gas emissions from processing energy such as:*
  a) conserving energy;
  b) using cleaner sources of energy such as renewable energy and natural gas instead of coal, oil or electricity;
  c) reducing heat losses from boilers through better design and insulation;
  d) reducing chilling and refrigeration energy through more efficient equipment and practices, and through staff training;
  e) reducing gas use by installing biofilters rather than afterburners;
  f) reducing the volume of heated wastewater generated;
  g) installing heat exchangers to preheat fresh processor water using hot wastewater;
  h) concentrating organic wastes from solids and wastewater to improve the viability of energy recovery from biogas collected from anaerobic ponds;
  i) reducing wastewater aeration requirements by minimising wastewater volumes and organic loads through water conservation and recovery of fats and blood; and
  j) reducing energy use by wastewater treatment aerators through better systems.
- *Adopt best practice measures to reduce greenhouse gas emissions from transport, for example conversion of vehicles to gas and reducing transport distances.*
- *Adopt best practice measures to reduce greenhouse gas emissions from organic waste such as:*
  a) reducing the total organic waste load through more efficient processing;
  b) biogas recovery and flaring;
  c) energy recovery;
  d) managing waste aerobically through aeration and/or composting;
  e) managing manures and sludges applied to land to avoid anaerobic conditions or over-application of nitrogen.
- *Seek means of increasing the value of products in order to reduce emissions per dollar.*
- *Investigate the potential for marketing 'greenhouse responsible meats'.*
- *Consider greenhouse issues in investment decisions.*
- *Consider diversifying the range of meat products they process.*
- *Encourage reduction in greenhouse gas emissions from livestock suppliers through measures such as:*
  a) Education about greenhouse management measures;
  b) Establishing supplies having lower emission intensities;
- *Adopt best practice measures to reduce greenhouse gas emissions from livestock holding yards such as:*

a) adoption of enteric methane inhibitors (when available);
b) improving production efficiencies; and
c) reducing emissions from waste through aerobic management or biogas recovery for flaring or preferably energy recovery.

14. It is recommended that the meat and livestock industry:

- *Facilitate improved processing performance by actions such as:*
  a) helping operators through information, contacts and best practice guidelines;
  b) benchmarking practices so operators know how they compare with others in Australia and overseas;
  c) assessing and publicising measures to improve greenhouse performance; and
  d) encouraging operators to join the Federal Government's Greenhouse Challenge *program.*

- *Help livestock producers in managing their greenhouse liabilities through supporting:*
  a) data collection to allow benchmarking of emission levels in different states, regions and growing conditions.
  b) research funding for anti-methanogens and other means of reducing livestock emissions;
  c) carbon trading outcomes that protect the interest of livestock producers;
  d) development of land management accreditation systems that allow governments to verify reduced livestock emission levels at least cost to land managers;
  e) government assistance in programs to help the livestock sector to reduce its greenhouse gas emissions;
  f) education programs; and
  g) development of greenhouse accreditation systems for livestock producers that will assist individual producers to demonstrate that they have achieved reductions in emissions

- *Build advocacy capacity by building alliances with linked organisations and maintaining a watching brief.*

- *Consider seeking government authorisation for the exclusion of livestock emissions from any carbon trading system that does not include livestock emissions in non-Annex B nations. (However, exclusion from carbon trading systems may prevent landowners gaining possible rewards available through the trade of 'carbon credits' gained by increasing stored carbon in biomass and soil.)*

- *Seek government assistance in the form of funding and technical support for greenhouse responses.*

- *Ensure representation so that government pays sufficient attention to possible impacts of some policy measures.*

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ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
AGO	Australian Greenhouse Office
AMPC	Australian Meat Processor Company
CH_4	methane
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
COP	the Conference of Parties (to the Framework Convention on Climate Change)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
HSCW	hot standard carcass weight
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram
MLA	Meat and Livestock Australia
N_2O	nitrous oxide
PFCs	perfluorocarbons
SF_6	sulphur hexafluoride
t	tonne

GREENHOUSE JARGON

Abatement	Reduction (in emissions).
Acquittal	Discharge of an obligation under a carbon trading system to surrender permits corresponding to a quantity of greenhouse gas emissions.
Annex B countries	Signatories to the Kyoto Protocol – generally developed countries – that are subject to limitations in greenhouse gas emissions.
Assigned amount	The quantity of carbon dioxide equivalent emissions a country is allowed to emit under the terms of the Kyoto Protocol.
Baseline and credit	A type of emissions trading system in which participants have rights to freely emit to some baseline level, must obtain permits to emit beyond this level, and, if their emissions are below this level, are able to sell rights to the difference.
Cap and trade	A type of emissions trading system in which the total emission level is fixed and participants must obtain permits for all of their emissions.
Carbon credits	Verified units of carbon removed from the atmosphere (especially by forests) that may be tradable under a carbon trading system similarly to emission permits.
Carbon dioxide equivalent	A means of comparing the warming effect of greenhouse gases, based on their warming effect relative to that of carbon dioxide.
Carbon trading system	An emissions trading system specific to greenhouse gas emissions.
Clean development mechanism	A mechanism established in Article 12 of the Kyoto Protocol which enables signatory developed countries to obtain credit through projects which assist non-signatory developing countries to reduce greenhouse gas emissions.
Commitment period	Period during which emissions must be limited to the amount assigned by international agreement (the first commitment period under the Kyoto Protocol is 2008 to 2012).
Enteric	Of the intestines.
Flexibility mechanisms	Articles of the Kyoto Protocol that provide countries with flexibility in reaching their targets, *viz* joint implementation, the clean development mechanism and international carbon trading.
Grandfathering	An administrative allocation of initial emission permits under a carbon trading system based on to historical emission outputs.
Joint implementation	A mechanism established in Article 6 of the Kyoto Protocol which enables signatory developed countries to obtain credit through projects which assist other signatory countries to reduce greenhouse gas emissions.
Kyoto Protocol	An key international agreement made in Kyoto, Japan in 1997 that set country-by-country greenhouse gas emission limits.

No regrets policy	A principle for Australian government greenhouse policy specifying that (initial) emission abatement efforts should be those without net financial cost.
Sequestration	Removal of carbon dioxide in processes that 'fix' atmospheric carbon and retain it in a 'sink'.
Sink	A process, activity or mechanism which removes a greenhouse gas or precursor of a greenhouse gas from the atmosphere.

1 INTRODUCTION

This report was commissioned by Meat and Livestock Australia (MLA) and the Australian Meat Processor Company (AMPC) to examine the potential impacts on the red meat processing sector of government policy responses to the enhanced greenhouse effect. A particular concern is the possible impacts of carbon trading, a system for letting market forces determine the allocation of the right to emit greenhouse gases. Carbon trading has widespread support within government and industry as a method for reducing greenhouse gas emissions.

The report assesses the likely impacts of greenhouse policy on the sector and suggests strategies for individual meat processors and the industry as a whole to minimise potential costs and maximise potential benefits. It focuses on issues directly relevant to meat processing operators, including auxiliary operations such as feedlots. It also considers important 'upstream' emission sources but disregards related operations generally carried out by other companies such as hide and tallow processing.

The conclusions and recommendations of the report are contained in the following chapter (Chapter 2). . Key findings are summarised and likely trends arising from greenhouse policy are assessed. A series of nine recommendations to processors and five to peak industry bodies are provided. The remainder of the report details and supports the key findings summarised in Chapter 2.

The main body of the report opens with a general introduction to greenhouse science (Chapter 3) and greenhouse policy (Chapter 4), with a focus on issues relevant to red meat processors. These are followed in Chapter 5 by a discussion on carbon trading, covering the theory of how such trading systems work and exploring the various possible configurations for an Australian carbon trading system. The likelihood and possible timing of a carbon trading system are addressed.

In Chapter 6, the potential impacts of carbon trading and other greenhouse policy measures on the meat processing sector are considered. This chapter opens with an examination of the greenhouse gas emissions from red meat production, leading to analysis of the likely impacts on individual processors and on the sector collectively.

Possible operator and industry responses are canvassed in Chapter 7, which contains separate sections on response options for meat processors, livestock producers and the industry collectively.

While jargon is kept to a minimum, the technical and global nature of greenhouse discussion generates specialist words and phrases that are used when necessary. These are defined in a section given just after the Table of Contents. Abbreviations are explained in the same section. References and suggestions for further reading are given in footnotes in the relevant area of the document. An appendix containing useful websites is also provided.

2 CONCLUSIONS AND RECOMMENDATIONS

This chapter reviews key report findings, discusses in brief what they mean for the industry, and predicts likely trends in the industry arising because of greenhouse policy. The chapter closes with recommendations to meat processors and to the industry as a whole. Chapters 3 to 7 provide the arguments to support these findings and examine greenhouse science, greenhouse policy, carbon trading systems, the potential impacts of greenhouse policy on meat processors, and how the industry can respond to the challenge posed by society's responses to the enhanced greenhouse effect.

2.1 MAIN FINDINGS OF THE REPORT

The scientific consensus is that an enhanced greenhouse effect is underway. International negotiations led to 1997 Kyoto Protocol, in which Australia agreed to restrict its emissions growth to 8% over 1990 levels during the first commitment period from 2008 to 2012. Australia's greenhouse gas emissions are dominated by CO_2 from burning fossil fuels, but CH_4 emissions from livestock are also prominent.

Australia has established a multi-faceted program to reduce its emissions to meet its Kyoto commitments, including education, assistance to industry, support for renewable energy and setting up a specialist Australian Greenhouse Office to administer government policy.

In addition, the government is investigating setting up a carbon emissions trading system that would allow trading of both permits to emit and carbon credits generated through activities that 'fix' carbon. The system would be linked to international trading to be established under the Protocol and would probably become operational in 2008. Other design details of Australian carbon trading are not yet clear. Uncertainties include:

- the nature of the international system;
- how initial permits would be allocated (most likely, they will be partly 'grandfathered' based on historical emissions and partly sold at auction);
- which sectors and activities would be included (likely criteria for exclusion include high cost of measurement and verification, high risk of damage to the sector, high social and political costs, and availability of alternative policies); and
- how much permits would cost (this depends on the number of activities included and of nations participating).

Red meat production gives rise to greenhouse gas emissions from livestock, some land management practices, transport, use of electricity, use of gas and other fuels, solid waste management and wastewater treatment. Enteric CH_4 emissions from cattle and sheep in farms, feedlots and abattoir holding yards contribute about 90% of total emissions from the sector and 15% of national emissions. Electricity and waste management are the source of most of the rest of the industry's emissions, but transport emissions are generally somewhat less important except where stock are transported long distances. Little is known about the extent of credits or liabilities from the greenhouse impacts of land management, how these impacts should be managed, and how they will be dealt with by the Kyoto Protocol and carbon trading systems.

Not all countries have Kyoto commitments. The protocol sets emissions reductions targets for developed industrial nations (referred to in the Protocol as 'Annex B' nations). Not all Annex B nations (most notably the USA) have

ratified the Protocol, which will not come into effect until 90 days after it is ratified by 55 Parties to the Convention representing at least 55% of emissions from Annex B nations. Non-Annex B nations, including some significant meat exporting nations, do not have binding Kyoto commitments and would therefore not be made to participate in international carbon trading systems should these be introduced.

Meat processors are directly responsible for the emissions from their facilities and, under a carbon trading system, could be required to monitor, verify and purchase permits to cover these emissions. However, processors may be more significantly affected by 'upstream' emissions from livestock, which could lead to dramatic cost increases that could affect the viability of livestock production in many parts of Australia (see Box 1).

The livestock sector is a good candidate for initial exclusion from a carbon trading system due to the cost of measurement and verification, and the likely impact on the industry and its communities that could follow. However, this may also mean exclusion from the benefit of carbon credits.

Box 1: Summary of likely red meat processing cost increases under a carbon trading system (permits at $30/t CO_2-e)

Input	***Cost increase at permit cost of $30/t CO_2-e*** *(¢ per kg HSCW)*
Cattle	*19- 61*
Sheep	*18-75*
Electricity	*1*
Transport	*0.5*
Wastewater management	*0.5*
Solid waste management	*0.5*

Because the sector contributes about 16% of Australia's greenhouse emissions, there is no chance of the industry being ignored by policy makers. Whether or not carbon trading is established and whether or not it includes livestock emissions, greenhouse policy is likely to change the economics of meat production and to detrimentally affect broad-scale livestock producers in particular.

Greenhouse policy is likely to encourage a shift towards intensive production such as feedlots from less intensive and less efficient broad-acre operations, unless these are able to compensate for their emissions by producing carbon sinks. Complementary products such as wool are also likely to become more expensive. Australian meat producers may be disadvantaged in relation to the large South American and other exporters which are not subject to mandatory emission reduction targets. Some demand for red meat may be deflected towards alternative products.

Options are available for the sector to respond to the greenhouse challenge.

- Meat processors can improve process energy and transport efficiencies and reduce emissions from waste. They can increase the value of their products, consider greenhouse issues in their investment decisions, consider diversifying and encourage suppliers to reduce emissions.
- Livestock managers (including owners of holding yards) may be able to substantially reduce enteric CH_4 through feed additives and/or vaccines, improve production efficiency, reduce stock numbers on grazing land, exploit the benefits of carbon sinks, improve waste management in feedlots and increase the value of their products.
- The industry collectively can facilitate improved greenhouse performance by its members, support and educate livestock producers and allied industries, build advocacy capacity in the industry, seek government support and ensure its voice is heard in Canberra.

Implementing these options will help to reduce the sector's liabilities and help produce the best possible policy outcome.

KEY POINTS – MAIN FINDINGS OF THE REPORT

- *The scientific consensus is that an enhanced greenhouse effect is underway.*
- *Australia has established a multi-faceted program to reduce its emissions and is investigating setting up a carbon emissions trading system.*
- *Meat production gives rise to greenhouse gas emissions from a range of processes. Emissions are dominated by enteric CH_4 from livestock.*
- *Meat processors could face dramatic increases in the cost of livestock.*
- *The livestock sector is a good candidate for initial exclusion from carbon trading but there is no chance of the industry being ignored by policy makers.*
- *Greenhouse policy is likely to encourage a shift towards intensive production from less intensive and less efficient broad-acre operations.*
- *Options are available for the sector to respond to the greenhouse challenge that will reduce the sector's liabilities.*

2.2 LIKELY TRENDS IN POLICY, MARKETS AND PRODUCTION

A carbon trading system will probably be established in Australia and internationally within the next few years. It is the authors' view that agricultural operations will not initially be required to participate, but that a series of alternative policy measures will be applied to the sector to encourage emission abatement.

Carbon trading and other greenhouse policy measures represent a new set of influences on meat production, meat markets and the Australian economy. Likely trends arising out of these influences are discussed below.

2.2.1 Likely trends in ruminant livestock raising

Greenhouse policy measures will create incentives for ruminant livestock producers to reduce their greenhouse gas emissions per head, per kilo, per hectare and per dollar value of product.

It is the authors' view that this will lead to:

- more efficient production techniques, including supplementary feed and improved pasture management, so that younger slaughter ages are achieved (particularly for sheep);
- reduced viability of livestock grazing on unimproved pastures and in areas with seasonally poor feed, resulting in a contraction of grazing in marginal areas;
- greater use of feedlots, especially for young cattle;
- strengthened markets for land suitable for productive forests; and
- industry and government supported 'greenhouse efficient livestock producer' accreditation schemes that certify use of emission-reducing production practices, including:
  - digestion intervention techniques that reduce enteric CH_4 production; and
  - land management techniques that improve carbon sink capacities.

2.2.2 Likely trends in meat processing

Greenhouse policy measures will create incentives for meat processors to reduce their greenhouse gas emissions, and those of their suppliers, per unit of HSCW / dressed weight and per dollar value of product.

It is the authors' view that greenhouse policy will lead to:

- higher prices for livestock and red meat products;
- pressure from processors that suppliers participate in approved 'greenhouse efficient livestock producer' accreditation schemes.
- greater processing energy efficiency and heat recovery;
- greater up-take of biogas capture from wastes for flaring and/or energy recovery;
- increased value adding; and
- greater rationalisation of abattoirs, including feedlots, to economies of scale where full integration (and possibly energy recovery) is viable.

2.2.3 Likely trends in meat markets

Greenhouse policy measures are likely to reduce the competitiveness of Australian red meat in comparison to less greenhouse-intensive meats, alternative non-meat products and red meat exports from countries that do not face the cost increases arising from mandatory emission abatement.

It is the authors' view that this will lead to:

- a relative decline in demand for domestic beef and sheep meat in both Australia and overseas markets;
- more exports from non-Annex B meat producing nations (such as Uruguay, Argentina, Chile and Brazil) including imports to Australia;
- increased dietary switch to chicken, pig meat and non-meat products; and
- markets for 'greenhouse friendly' products.

2.2.4 Likely trends in the Australian and global economies

Carbon trading and other greenhouse policy measures are likely to significantly affect the Australian and global economies, promoting energy efficiency and 'renewable' energy, increasing the price of greenhouse-intensive products and services and encouraging relocation of some industries.

It is the authors' view that this will lead to:

- higher prices for fossil fuel energy and petroleum derived products (including synthetic fertilisers and fibres);
- stronger markets for and investment in renewable and less greenhouse intensive energy;
- technological and management innovations that improve energy efficiency across the economy and reduce greenhouse gas emissions from other sources such as waste;
- businesses and sectors with high turnover per unit greenhouse emission and few opportunities to cost-effectively reduce emissions 'buying out' permits from highly greenhouse intensive businesses.
- displacement of some greenhouse-intensive production to developing countries that lack greenhouse emission caps.

KEY POINTS – LIKELY TRENDS IN POLICY, MARKETS AND PRODUCTION

It is the authors' view that:

- *a carbon trading system will be established internationally and in Australia.*
- *agricultural operations will be initially exempt from compulsory participation in the system, but alternative policy measures will be applied to the sector.*

It is the author's view that greenhouse policy will lead to:

- *more efficient ruminant livestock raising, contraction of marginal grazing and increased feedlotting;*
- *establishment and take-up of 'greenhouse efficient livestock producer' accreditation schemes;*
- *higher prices for livestock and red meat products;*
- *greater rationalisation of abattoirs and more efficient meat processing ;*
- *a decline in demand for Australian red meat and increased dietary switch to chicken, pig meat and non-meat products; and*
- *significant impact on the Australian and global economies.*

2.3 RECOMMENDATIONS

Recommendations are given to individual operators and to the processing industry as a whole.

In general, it is recommended that operators and the industry collectively should be proactive reducing its greenhouse gas emissions and preparing for increasingly demanding government greenhouse policies. This is considered to be the most effective approach for operators and the industry to minimise its greenhouse liabilities and maximise its leverage with policy makers.

Further detail and explanation on these recommendations is provided throughout the report, particularly in Chapter 7.

2.3.1 Recommendations to meat processors

- *Adopt best practice measures to reduce greenhouse gas emissions from processing energy such as:*
  - *conserving energy;*
  - *using cleaner sources of energy such as renewable energy and natural gas instead of coal, oil or electricity;*
  - *reducing heat losses from boilers through better design and insulation;*
  - *reducing chilling and refrigeration energy through more efficient equipment and practices, and through staff training;*
  - *reducing gas use by installing biofilters rather than afterburners;*
  - *reducing the volume of heated wastewater generated;*
  - *installing heat exchangers to preheat fresh processor water using hot wastewater;*
  - *concentrating organic wastes from solids and wastewater to improve the viability of energy recovery from biogas collected from anaerobic ponds;*

- *reducing wastewater aeration requirements by minimising wastewater volumes and organic loads through water conservation and recovery of fats and blood; and*
- *reducing energy use by wastewater treatment aerators through better systems.*

- *Adopt best practice measures to reduce greenhouse gas emissions from transport, for example conversion of vehicles to gas and reducing transport distances.*

- *Adopt best practice measures to reduce greenhouse gas emissions from organic waste such as:*
  - *reducing the total organic waste load through more efficient processing;*
  - *biogas recovery and flaring;*
  - *energy recovery;*
  - *managing waste aerobically through aeration and/or composting;*
  - *managing manures and sludges applied to land to avoid anaerobic conditions or over-application of nitrogen.*

- *Seek means of increasing the value of products in order to reduce emissions per dollar.*

- *Investigate the potential for marketing 'greenhouse responsible meats'.*

- *Consider greenhouse issues in investment decisions.*

- *Consider diversifying.*

- *Encourage reduction in greenhouse gas emissions from livestock suppliers through measures such as:*
  - *education about greenhouse management measures;*
  - *establishing supplies having lower emission intensities;*

- *Adopt best practice measures to reduce greenhouse gas emissions from livestock holding yards such as:*
  - *adoption of enteric methane inhibitors (when available);*
  - *improving production efficiencies; and*
  - *reducing emissions from waste through aerobic management or biogas recovery for flaring or preferably energy recovery.*

2.3.2 Recommendations to the meat processing industry

- *Facilitate improved processing performance by actions such as:*
  - *helping operators through information, contacts and best practice guidelines;*
  - *benchmarking practices so operators know how they compare with others in Australia and overseas;*
  - *assessing and publicising measures to improve greenhouse performance; and*
  - *encouraging operators to join the Federal Government's* Greenhouse Challenge *program.*

- *Help livestock producers in managing their greenhouse liabilities through supporting:*
  - *data collection to allow benchmarking of emission levels in different states, regions and growing conditions.*

- *research funding for anti-methanogens and other means of reducing livestock emissions;*
- *carbon trading outcomes that protect the interest of livestock producers;*
- *development of land management accreditation systems that allow governments to verify reduced livestock emission levels at least cost to land managers;*
- *government assistance in programs to help the livestock sector to reduce its greenhouse gas emissions;*
- *education programs; and*
- *development of greenhouse accreditation systems for livestock producers that will assist individual producers to demonstrate that they have achieved reductions in emissions*

- *Build advocacy capacity by building alliances with linked organisations and maintaining a watching brief.*

- *Consider seeking government authorisation for the exclusion of livestock emissions from any carbon trading system that does not include livestock emissions in non-Annex B nations. (However, exclusion from carbon trading systems may prevent landowners gaining possible rewards available through the trade of 'carbon credits' gained by increasing stored carbon in biomass and soil.)*

- *Seek government assistance in the form of funding and technical support for greenhouse responses.*
- *Ensure representation so that government pays sufficient attention to possible impacts of some policy measures.*

3 GREENHOUSE SCIENCE

3.1 THE ENHANCED GREENHOUSE EFFECT

3.1.1 What is it?

The greenhouse effect is a natural phenomenon that maintains the temperature of the earth within a range that sustains existing life forms (see Box 1). Over the past few decades, scientific research, experiments and computer models have indicated that the natural greenhouse effect is being intensified by increased emissions of greenhouse gases produced by human activities since the industrial revolution. The most important of these gases is carbon dioxide (CO_2) followed by methane (CH_4) and nitrous oxide (N_2O) – see Figure 1. The most significant activity is burning of fossil fuels to release CO_2. Clearing of forests is also important.

Box 1: How the greenhouse effect works

Heat from the sun arriving at the earth as short-wave radiation, absorbed by the earth's surface and re-emitted as long-wave radiation. Without an atmosphere this long-wave radiation would all escape into space, but water vapour, carbon dioxide and certain other gases in the atmosphere absorb some of the outgoing radiation and re-emit it back to the surface.

The effect of these so-called greenhouse gases is to maintain the temperature of the earth some 33°c hotter than it would be without an atmosphere.

Accumulation of greenhouse gases due to human activity is the cause of the enhanced greenhouse effect.

The so-called 'enhanced greenhouse effect' could lead to significant climate change. Evidence is growing that change is already occurring (see Box 2).

There is much uncertainty about the magnitude and rates of change. 'Mid-range' estimates from the Intergovernmental Panel on Climate Change[1] suggest:

- a global average temperature increase of about 2°C by 2100 with significant local variation;
- sea level rise of about 50cm; and
- more severe and variable rainfall and drought events.

Such changes could seriously affect the global ecology and economy.

CSIRO predictions for northern Australia in 2030 include a decrease of up to 8% in winter rainfall coupled with more intense summer rainfall events[2].

3.1.2 What can be done?

Climate change will be moderated if greenhouse gas concentrations in the atmosphere decrease. This could occur if:

- emissions from combustion of fossil fuels are reduced, for example through reduced energy consumption, more efficient energy use, conversion to less greenhouse intensive fuels such as natural gas, or injection of CO_2 emissions into deep aquifers;
- emissions from other sources are reduced, for example through food supplements or vaccines to reduce emissions from livestock, and collection and burning of landfill gas; and/or
- the biomass on earth is increased, for example by growing forests or managing land to increase carbon stored in the soil.

[1] IPCC Second Assessment Report: Climate Change 1995, available at www.ipcc.ch/pub/reports.htm

[2] Walsh K, Hennessy K, Jones R, Pittock B, Rotstayn L, Suppiah R and Whetton P (2000) *Climate Change in Queensland under Enhanced Greenhouse Conditions*. Report on research undertaken for Queensland Departments of State Development, Main Roads, Health, Transport, Mines and Energy, Environmental Protection Agency, Treasury, Public Works, Primary Industries and Natural Resources. CSIRO Atmospheric Research, Melbourne.

KEY POINTS – THE ENHANCED GREENHOUSE EFFECT

- *Most scientist believe that increased emissions of greenhouse gases due to human activities are causing an enhanced greenhouse effect that will lead to climate change.*
- *Climate change is a potentially serious threat to the global ecology and economy.*
- *Management actions could moderate climate change.*

3.2 AUSTRALIA'S GREENHOUSE GAS EMISSIONS

Each greenhouse gas has a different warming intensity and acts over a different timeframe. By convention, the warming effect of a quantity of any gas is measured in CO_2 equivalence (CO_2-e), being the amount of CO_2 that would be needed to produce the same warming effect over a 100 year timeframe. For example, the CO_2 equivalence of a CH_4 emission is calculated by multiplying the mass by 21, and the CO_2 equivalence of a N_2O emission is calculated by multiplying by 310.

Figure 1 shows the composition of Australia's 1997 net greenhouse gas emissions, which totalled 431 Mt CO_2-e (excluding land clearing)[3]. The dominant source, comprising 67% of the total, is CO_2, emitted largely during the production and consumption of fossil fuels. The second most important gas is CH_4, major sources of which include livestock and the anaerobic decay of organic waste.

Box 2: Is the enhanced greenhouse effect real?

Predictions of an enhanced greenhouse effect were originally based on the observed properties of gases known to be accumulating in the atmosphere due to human activities. These theoretical predictions are now starting to be borne out by observations of climatic behaviour and the outputs of complex models of the earth's climate system.

There is always uncertainty in dealing with complex systems. It is widely recognised and not fully explained that climate has varied throughout geologic history. This natural variability has given rise to healthy debate and, in some quarters, doubt about the reality of the greenhouse.

Although greenhouse sceptics are relatively few in the scientific community, they appear to have received disproportionate publicity due to promotional efforts by industries and countries with much to lose from greenhouse gas abatement.*

*The peak scientific body examining climate change has stated that "the balance of evidence suggests a discernable human influence on global climate"**. This 'balance of evidence' provides the context for international efforts to reduce greenhouse gas emissions.*

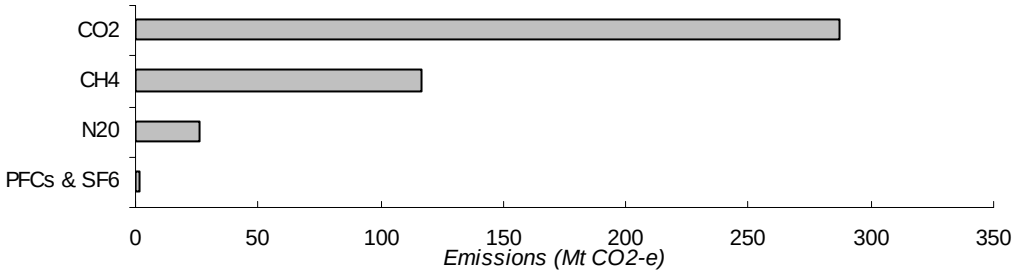
* see Sharon Beder's book 'Global Spin', Chelsea Green Publishing, 1997.
** IPCC Second Assessment Report: Climate Change 1995, available at www.ipcc.ch/pub/reports.htm

For further 'entry level' information, see http://www.pewclimate.org/index.html

For a greenhouse-sceptics view, see www.globalclimate.org/index.html

[3] For further information on Australia's greenhouse emissions, see Australian Greenhouse Office (1999) *National Greenhouse Gas Inventory 1997.* AGO, Canberra. This is available at no cost from AGO on 1300 130 606.

FIGURE 1: EMISSIONS BY GAS, AUSTRALIA 1997



Notes:

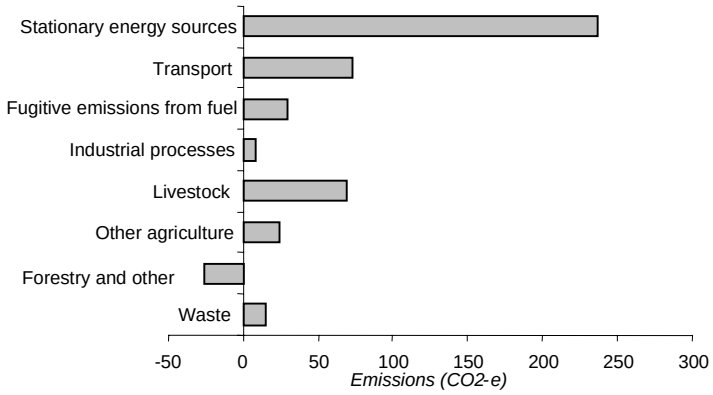
- Hydroflourocarbons are excluded due to the very high level of data uncertainty.
- A number of other 'indirect' greenhouse gases cannot be directly compared with CO_2.

Source: AGO (1999) *National Greenhouse Gas Inventory 1997.*

Figure 2, showing the sources of Australia's emissions (excluding land clearing), confirms the dominance of energy production and consumption as an emission source. Combined, stationary energy use, transport and fugitive fuel emissions accounted for 79% of total emissions. Emissions from meat processing fall into several of the sectors shown in Figure 2 including stationary energy, livestock, other agriculture (manure management) and waste (discharges to sewer). Note that livestock accounted for a substantial 16% of Australia's emissions (see Box 3).

On a per capita basis Australians are very high contributors to the global greenhouse emissions, being responsible for about 2% of estimated global human-induced emissions despite making up only about 0.3% of the world's population.

FIGURE 2: EMISSIONS BY SECTOR, AUSTRALIA 1997



Source: AGO (1999) *National Greenhouse Gas Inventory 1997,* AGO

KEY POINTS – AUSTRALIA'S GREENHOUSE GAS EMISSIONS

- *Energy, transport and livestock production are the major contributors to Australia's greenhouse emissions.*
- *Australia has very high per capita greenhouse gas emissions.*

4 GREENHOUSE POLICY

Governments at national, state and local level are responding to the threat of climate change through legislation and other measures to reduce emissions, adjust to new climate scenarios and learn more about the enhanced greenhouse effect. In this chapter, policy responses important to the Australian economy and to meat processors are reviewed.

4.1 INTERNATIONAL GREENHOUSE POLICY

The first milestone in the international negotiations towards an effective global response to the threat of climate change was the 1992 Framework Convention on Climate Change, which was signed by 154 countries including Australia. The second milestone, which occurred in 1997 at the 3rd meeting of the Conference of Parties (COP) that meet to implement the framework, was the Kyoto Protocol[4]. The Protocol includes an undertaking to limit the emissions from industrialised 'Annex B' countries (see Box 3) during 'commitment periods'. During the first commitment period from 2008 to 2012, the combined emission limit is 95% of these countries' combined 1990 levels. Within this overall objective, individual countries are allotted 'assigned amounts' of emissions that vary as a proportion of their 1990 level.

Due to the energy intensive nature of its economy, Australia successfully argued for an increased assigned amount of 108% above its 1990 levels for the first commitment period. Emission growth of 8% is substantially lower than that projected under a 'business as usual' scenario.

To become legally binding, the Protocol must be ratified by at least 55 countries accounting for at least 55% of Annex B country 1990 emissions. This has not yet occurred. Australia, like many countries, has signed but not yet ratified the Protocol. The delay hinges largely on the detailed negotiations to implement the Protocol, which are developing progressively at the COP. The next meeting, COP6 in The Hague in November 2000, is scheduled as a crucial milestone in implementing the Protocol. COP6 may also set a target date for bringing the Protocol into force.

The biggest hurdle to implementation of the Kyoto Protocol is American opposition, particularly from the Republican-dominated Congress and Senate. It is argued that the Protocol would disadvantage US companies competing against businesses in developing countries, and that these should therefore be included in any greenhouse gas control agreement. (The Protocol does not require developing countries to limit emissions, on the grounds that the problem has been created almost entirely by the industrial countries so these should take the lead in the solution.)

Box 3: Annex B countries under the Kyoto Protocol

Australia
Austria
Belgium
Bulgaria
Canada
Croatia
Czech Republic
Denmark
Estonia
European Community
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Japan
Latvia
Liechtenstein
Lithuania
Luxembourg
Monaco
Netherlands
New Zealand
Norway
Poland
Portugal
Romania
Russian Federation
Slovakia
Slovenia
Spain
Sweden
Switzerland
Ukraine
UK
USA

[4] The Kyoto Protocol is available at www.unfccc.de/resource/docs/convkp/kpeng.html

The Kyoto Protocol could collapse if the US continues to refuse to ratify. However, since 84 countries have now signed, it is unlikely that the Protocol's failure would spell the end of international moves to curb greenhouse gases. Rather, some alternative agreement would most likely eventuate which had a similar function of partitioning emission rights in a greenhouse-limited or 'carbon-constrained' economy. Many believe Australia could be disadvantaged by a collapse of the Kyoto Protocol because it would be unlikely to obtain such an exceptional deal in any subsequent negotiations.

KEY POINTS – INTERNATIONAL GREENHOUSE POLICY

- *Governments around the world have recognised the need to reduce global greenhouse emissions.*
- *Under the Kyoto Protocol, signatory industrialised (Annex B) nations have agreed to limit their emission rates.*
- *The Protocol may never come into force, but some alternative agreement would most likely then eventuate to partition emission rights in a 'carbon-constrained' economy.*

4.2 AUSTRALIAN GREENHOUSE POLICY

A 'no regrets' policy framework has driven most Australian government responses to climate change. This aims to facilitate emission reductions without forcing industry and the community to take costly actions that provide no benefit other than greenhouse gas abatement.

A National Greenhouse Strategy[5] was released in 1998, endorsed by the Commonwealth, State and Territory Governments. It focuses on:

- improving awareness and understanding of greenhouse issues;
- limiting the growth of emissions and enhancing greenhouse sink capacity (the most important area); and
- developing adaptation responses to climate change.

A dedicated Commonwealth government agency, the Australian Greenhouse Office (AGO), has been set up in Canberra. The AGO is the main administrator of about $1 billion in dedicated greenhouse response funding for the next 4 years[6].

Among the programs run by the AGO is the *Greenhouse Challenge* Program. Industries participating in this voluntary program negotiate a set of commitments with the AGO to reduce their greenhouse emissions by taking defined actions over a specified time scale. The AGO provides expert advice, training, literature and publicity.

The National Renewable Energy Policy requires electricity retailers to source 2% of their electricity from renewable sources by 2010. This will increase demand and probably prices payable for energy generated from sources such as wind, hydroelectricity, solar and CH_4 generated from organic wastes.

The Commonwealth is considering including greenhouse emissions as a 'trigger' for intervention under the new *Environment Protection and Biodiversity Act*, involving Commonwealth assessment of proposed projects and activities with prospective emissions over a threshold figure. This could affect some very

[5] Commonwealth of Australia (1998) *The National Greenhouse Strategy.* AGO, Canberra.
[6] The AGO's website is at www.greenhouse.gov.au

large grazing properties but is unlikely to affect any meat processing operations.

The AGO estimates that implementation of current government initiatives will reduce Australian greenhouse gas emissions in 2010 from 143% to 118% of 1990 levels. Since the Kyoto commitment is 108% of 1990 levels, it would appear that these measures are not enough. Indeed, Australia's emissions (excluding consideration of emissions from land clearing and reafforestation) have already substantially overshot the Kyoto target.

The following section discusses 'carbon trading' as an additional method of reducing greenhouse emissions and outlines developments to date in establishing a carbon trading system.

KEY POINTS – AUSTRALIAN GREENHOUSE POLICY

- *Australia has an emissions target of 108% of 1990 emissions to be achieved within the period 2008 and 2012. In a 'business as usual' scenario, emissions during this period would be about 143% of 1990 levels.*
- *The Federal government is committed to reduction targets and is developing mechanisms to achieve them, including assistance to help industries to reduce emissions.*
- *A range of programs have been established to reduce emissions. Carbon trading is proposed as an additional measure.*

5 CARBON TRADING

Carbon trading is a proposed policy measure in response to climate change in which trading of the right to emit greenhouse gas emissions is allowed. This chapter considers the theory and practice of emissions trading systems generally, examines the international and national policy drives for adopting carbon trading and discusses the basis of a possible Australian carbon trading system.

5.1 EMISSIONS TRADING SYSTEMS: THEORY AND PRACTICE

Emissions trading systems are a way of letting the market, rather than government, allocate the rights to discharge specified pollutants into the environment. The most common system employs a 'cap and trade' approach in which government specifies the total allowable emission load from all operators, divides this into discrete permit packages and issues these to emitters. Permits can then be bought and sold by emitters according to their needs. All emissions must be 'acquitted' by presenting to the government a corresponding number of permits.

Many economists favour emissions trading systems because theory suggests they can control emissions at the lowest cost to society. A rational emitter reduces emissions up to the point where any further reductions would cost more than the value of the permits. Emitters who are able to reduce emissions cheaply do so, and the corresponding permits become available to emitters wishing to expand production. This means that the cost of reducing emission is borne by those who can do so at the lowest cost.

Box 4: Case study in emissions trading - the Hunter River salinity trading scheme

Human activities in the Catchment of the Hunter River, NSW, have caused average river salinity to rise, affecting irrigation operations and the riverine ecology. By the early 1990s, community anger about saline discharges from mining companies and a power station was preventing the establishment of new mines, to the economic detriment of the region.

In 1995, NSW Environment Protection Authority set up a discharge trading scheme to complement traditional regulation and education programs in controlling salinity. A limit was set on the total amount of salt that can be discharged into the river and this was shared among licensed dischargers. These are allowed to discharge only up to the limit of their share and can sell any excess credits. Real time, publicly available monitoring has been established at all discharge points. Regular reductions in the quota drive overall pollution down.

The scheme gives individual industries a financial incentive to reduce the amount of salt they discharge and some flexibility in deciding the best timing and mix of pollution control measures. It has gained widespread community support and has successfully prevented saline discharges from impacting on river health. New mines have been established without significant community opposition.

For further information, see Environment Australia 1997 Environmental Incentives – Australian Experience with Economic Instruments for Environmental Management*. Environmental Economics Research Paper No. 5. EA, Canberra. See also the NSW EPA website at* www.epa.nsw.gov.au

KEY POINTS – EMISSIONS TRADING SYSTEMS: THEORY AND PRACTICE

- *Emissions trading systems are a way of letting the market, rather than government, allocate the rights to discharge pollutants to the environment.*
- *Economic theory suggests emissions trading systems can control emissions at the lowest cost to society.*

5.2 THE DRIVE TOWARDS CARBON TRADING

5.2.1 The Kyoto Protocol and carbon trading

The Kyoto Protocol provides the basis for an international carbon emissions trading system.

Article 17 allows developed countries to "participate in emissions trading for the purposes of meeting their commitments". Any such trading must be "supplemental to domestic actions" to meet the targets. The details and ground rules of international carbon trading are due for negotiation at COP6.

The Protocol permits other 'flexibility mechanisms' in which developed countries to acquire or transfer credits through participation in projects in other countries, either through joint investment with other developed countries ('Joint Implementation') or through investment in developing countries ('Clean Development Mechanism').

Box 5: Case study in emissions trading - US sulphur dioxide emissions trading

The US Environmental Protection Agency established a trading system for controlling atmospheric emissions of sulphur dioxide from electricity production, a major cause of acid rain. Emission allowances were established for existing facilities based on current capacity, current process efficiency and government determined limits, and a pool of allowances was held back for new operations. Companies are free to trade these allowances at market prices, and some 15 million inter-company exchanges occurred in the first three years of operation. Most allowances were purchased by other power producers, but environmental groups and others also bought small amounts to 'retire' the emissions.

Prior to establishment of the system it was estimated that the compliance cost of a traditional regulatory approach would be some $5 billion a year. Actual costs under the emission trading system have been estimated at only $2 billion per year – and acid rain has fallen dramatically.

For further information, see Environment Australia 1997 Environmental Incentives – Australian Experience with Economic Instruments for Environmental Management*. Environmental Economics Research Paper No. 5. EA, Canberra*.

5.2.2 Australian developments

Interest in establishing a domestic Australian carbon trading scheme has been high. Proponents believe carbon trading would give Australia its best chance to fulfill its commitments under the Kyoto Protocol, and any subsequent agreement, at least cost. Developments include:

- a 1998 statement by the Prime Minister that "Australia … would support emissions trading on the basis of a satisfactory initial allocation of emission entitlements and a practical resolution of administrative difficulties involved";
- comments by the Minister for the Environment indicating government intent to implement a domestic carbon trading system if Australia ratifies the Kyoto Protocol;
- a 1998 report from a House of Representatives Standing Committee that supported carbon trading and recommended an early trial;
- a commitment in the National Greenhouse Strategy to assess options for the establishment of a carbon trading scheme that would allow for eventual integration with an international trading system; and
- the release of a series of four discussion papers[7] which canvass Australia's options in establishing a domestic carbon trading system.

[7] The 1999 National Emissions Trading papers are titled: Establishing the Boundaries (No. 1); Issuing the Permits (No. 2); Crediting the Carbon (No. 3); and Designing the Market (No. 4). They are available from the AGO in Canberra, or at the AGO website at www.greenhouse.gov.au.

Submissions to government indicate broad, though qualified, support for carbon trading within industry and the community. Opposition has arisen from some industry groups such as the Electricity Supply Association of Australia, which argue that existing programs under the National Greenhouse Strategy should be given time to work alone. The objections focus on the potential economic cost of carbon trading and concern about its workability. The coal-fired electricity and aluminium businesses, in particular, are likely to be big losers in a carbon trading system[8].

KEY POINTS – THE DRIVE TOWARDS CARBON TRADING

- *The Kyoto Protocol allows for international carbon trading as a means to help countries achieve their emission reduction commitments.*
- *Australia is a strong supporter of carbon trading.*

5.3 AN AUSTRALIAN CARBON TRADING SYSTEM

The following discussion is based largely on the four AGO discussion papers prepared to consider the issues associated with establishing a national carbon trading system (see footnote 7).

5.3.1 The basics of an Australian carbon trading system

An Australian carbon trading system would need to be compatible with the requirements for international trading set out in the Kyoto protocol and to be further developed in international negotiations. It would need to cover the six main greenhouse gases (see Section 3.2) and to allow for Joint Implementation and the Clean Development Mechanism (see Section 5.2.1).

The basic structure of the system is likely to be the 'Cap and Trade' model described in Section 5.1. It would almost certainly be controlled by the Commonwealth Government.

Emitters would probably be required to acquit their emissions annually. If a business were unable to do so, it would probably be given a grace period to buy permits or credits. Failing this it would probably face a fine exceeding the cost of the permits. Government would hold back some permits as a buffer to insure against such failings and to cover sectors or activities excluded from the system due to impracticality or cost.

Trades could occur:

- from business to business;
- via brokers; and/or
- through institutional financial exchanges such as the stock exchange.

It is likely that all legal entities would be allowed to participate, including industry groups, environmental groups and foreign companies.

In addition to permits and credits generated in Australia, the establishment of an international system would provide tradable units from:

- permits and credits purchased overseas; and
- credits from Joint Implementation or the Clean Development Mechanism.

All would have the same value, which is expected to be one tonne of carbon dioxide equivalent during the commitment period.

[8] ACG (Allen Consulting Group 2000) *Greenhouse Emission Trading*. Victorian Government, Melbourne.

As well as trade in permits and credits, markets in carbon futures and options are likely. Initial trades have already begun.

5.3.2 Carbon credits

In the natural carbon cycle, growing plants absorb or 'sequester' CO_2 from the atmosphere and store the carbon in organic material. When this organic material decays or is respired the carbon is emitted back to the atmosphere as CO_2. Organic matter therefore acts as a carbon 'sink', storing large quantities of carbon mainly in vegetation and soils. Changes in the size of this sink (for example through land clearing, forest fires, logging or tree planting) affect atmospheric concentrations of CO_2.

Article 3.3 of the Kyoto Protocol requires countries to include net emissions or sequestration from "direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990" in meeting their commitments. As well, Article 3.4 allows voluntary inclusion of "additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories". Australia was a key advocate of these clauses.

Any national carbon trading scheme, as well as encompassing greenhouse gas emissions, will almost certainly allow for trading of carbon sequestered by 'Kyoto forests' during the first commitment period 2008 to 2012, and for use of these 'carbon credits' to offset greenhouse gas emissions. Sequestration in other categories will probably be included. Carbon credits are another flexibility mechanism for assisting countries meet their Kyoto targets.

While the broad framework for carbon credits trading is clear, there is much uncertainty about the detail. The possible rules for voluntary inclusion of carbon sequestered due to changes in management of soils and non-forestry biomass, in particular, are problematic and not well established. It is expected that COP6 will help resolve some of this uncertainty[9].

Box 6: Controversy about use of flexibility mechanisms

There is some disagreement about the degree to which flexibility mechanisms – such as carbon trading, joint implementation, the clean development mechanism and carbon credits – should be allowed under the Protocol.

The European Union believes that reduction of emissions should be primarily through domestic action and use of flexibility mechanisms should be limited. Most developing countries argue that the clean development mechanism should be the primary flexibility mechanism. Australia and the US are part of the 'umbrella group' that argues against any kind of restriction and is keen to develop the framework for a comprehensive international trading system.

In Australia, there has been some controversy about the perceived extent to which the government is focusing on carbon credits as a means of achieving its Kyoto targets. Some green groups, including the Australian Conservation Foundation and Greenpeace, have accused the government of focusing on carbon sinks as a means of avoiding the central issue of reducing CO_2 emissions from burning fossil fuels. In response, the government has drawn attention to the anomaly of green groups 'objecting' to programs that encourage tree-planting. For further information see:
www.acfonline.org.au/campaigns/globalwarming/discussion/carbonsinks.htm
and
www.abc.net.au/lateline/archives/s120215.htm

It is anticipated that carbon trading would be devolved to the private sector and conducted on a voluntary

[9] For further information, see AGO (2000) *Greenhouse Sinks and the Kyoto Protocol.*

basis. Carbon sink operators would need to measure, monitor and report on the sequestered carbon and arrange appropriate verification processes. Importantly, the existence of a carbon sink implies a liability if the size of the sink is reduced by logging, fire or other means.

There has been great interest in the opportunities afforded by carbon credits trading from a diverse range of groups including foresters, farmers and large-scale greenhouse gas emitters such as power generators. Carbon credit trading could stimulate forestry activities and offer Australia a relatively low cost option to offset greenhouse gases. A window of opportunity exists over the next few years for planting trees that will achieve good growth rates during the first Kyoto Protocol commitment period to maximise the potential for earning carbon credits. However, because of the high cost of registration, measurement, verification, insurance and transaction costs, "the beneficiaries of carbon credits are likely to be timber plantation owners in high-rainfall areas, principally the 'larger players'[10].

Trade in carbon credit futures has already commenced in Australia, including purchases in Australia by Delta Electricity, Pacific Power and the Tokyo Electric Power Company.

5.3.3 When would carbon trading system be established?

If the Kyoto Protocol comes into force, international trading will probably commence at the start of the first Kyoto commitment period in 2008. As a strong supporter of carbon trading, an Australian system would almost certainly be operational at that time.

There has been some support, including comments by the Minister for the Environment, for the establishment of a domestic Australian trading system before 2008 should Australia ratify the Protocol. Proponents of early carbon trading system have argued that it would:

- provide 'lead times' allowing planning for gradual emission reduction;
- allow 'learning by doing' whereby companies develop expertise in managing emissions under a permit trading regime before international commitments become legally binding; and
- provide valuable early experience – for example, development of expertise in Clean Development Mechanism measures could allow Australia to win the best opportunities when international trading starts.

An emission 'cap' for the early trading system could be set by the Commonwealth government, perhaps at a less onerous level than Kyoto to encourage gradual emission abatement action rather than sudden action when Protocol commitments become binding. Alternatively, a voluntary system could be established with the incentive of credits for early abatement measures. This would allow each emitter to weigh the potential costs and benefits of early participation.

Resistance to early emission trading has been strong, especially from industry groups. Opponents claim it would be unnecessarily expensive to move ahead of other countries. It could also be disruptive, should an early Australian system need to be changed to conform to subsequent international standards.

An August 2000 statement by government stated that the coalition government would not implement an early emission trading system.

[10] Hassall & Associates Pty Ltd (1999) *Greenhouse, Carbon Trading And Land Management*. LWRRDC Occasional Paper 23/99, Land and Water Resources Research and Development Corporation, Canberra.

However, industry has lobbied forcefully for recognition through 'credits' of pre-commitment period measures to reduce emissions. Importantly, any credits are likely to be available only to businesses that have signed up to the *Greenhouse Challenge* program (see Section 4.2).

Trading systems have already been established outside Australia. Canada, Denmark and the UK all have limited trading systems.

5.3.4 Who would need to obtain permits?

Ideally, all emission sources would be included in a carbon trading system. However, there may be good argument for excluding some industries or activities where:

- emissions are particularly expensive to measure and verify (including private monitoring and reporting as well as government administration, verification and enforcement);
- the financial impacts of carbon trading are particularly severe;
- the social and political costs of including the industry or activity are particularly high; and/or
- alternative approaches are available to reduce emissions from the industry or activity.

Possible candidates for exclusion include emissions from domestic properties, waste management and agriculture. In setting up the system, the government will need to find a balance in which the system is kept as comprehensive as possible while costs are kept realistic.

Some possible approaches to dealing with sectors or activities that are difficult to include in the system are:

- Indirect targeting through an emission permit focus that is 'upstream' or 'downstream' in the production and consumption chain. For example, the output of some 260 sites producing coal, oil and gas could fairly accurately predict the emissions from millions of downstream users. The producers would pass on their need to acquit emissions to the true emitters through price signals, and potentially through other measures such as advice on energy efficiency.
- Allowing voluntary participation in the system.
- Exclusion from the carbon trading system and use of alternative emission reduction approaches.

The idea of using upstream or downstream 'focus points' has attracted some criticism, particularly from industries where prices are set in international markets or international trade exposure is strong. These businesses, it is argued, have limited opportunity to pass on increased costs to downstream consumers and may be put at a competitive disadvantage in markets overseas and at home in comparison with imports.

A discussion on the likelihood of the exclusion of livestock production from a carbon trading system, and possible alternative policies, is given in Section 6.2.7.

5.3.5 How would initial permits be distributed?

Initial permits could be allocated by 'grandfathering', auctioning or a mix of the two. Grandfathering is an administrative allocation to emitters in proportion to their historical emission output. Auctioning is allocation to the highest bidder.

The debate about initial applications is a crucial concern to large scale emitters. Most favour grandfathering, arguing that:

- it is cheap and simple for both industry and government;
- it does not excessively penalise investment decisions taken in good faith prior to greenhouse commitments;
- it facilitates smooth establishment of carbon trading without sudden disruptive change; and
- auctioning is a tax impost that would disadvantage Australian businesses competing against overseas operators not required to pay for emission permits.

Opponents of grandfathering, including some energy efficient businesses, maintain that:

- it represents an unwarranted 'free gift' from society to existing operators;
- it disadvantages new market entrants who would need to buy all their permits on the open market; and
- it rewards inefficient operators by allocating to them a large number of permits.

Most probably, an initial allocation would try to balance these concerns by combining elements of grandfathering and auctioning. The administrative allocation part of a combined system could:

- cover historical emissions only partially so that businesses would need 'top up' permits from the open market;
- be based on a negotiated sectoral emission standard so that efficient operators would not be penalised for their efficiency; and/or
- be subject to a relatively small government charge, which could be gradually increased over successive commitment periods.

5.3.6 How much will emission permits cost?

Estimates of the likely cost of emission permits and carbon credits vary widely \$5 to \$191 per tonne CO_2-e, depending largely on the assumptions made about the details of the system. Costs would decrease with increased participation levels.

The AGO mid-range estimate is \$30 per tonne CO_2-e when international trading is established during the first commitment period. It is possible that prices for permits might be varied for different sectors, perhaps through government subsidy.

Without special government attention, high permit costs could seriously impact on some greenhouse intensive industries that have limited opportunity to cheaply reduce emissions.

5.3.7 Will it really happen?

An international carbon trading system will become established if:

- the Kyoto Protocol or a similar agreement comes into force; and
- Australia enacts legislation enabling carbon trading.

Mainly due to opposition by the USA to binding emissions reduction targets, the chances of the Protocol coming into force appear to be no better than even.

However, even if the Kyoto Protocol is abandoned it is likely that some similar agreement would sooner or later become established which would probably also allow carbon trading. Through one means or another, the threat of climate change is expected to lead to a 'carbon constrained economy'.

The chances of Australian involvement in carbon trading are high if the international framework is settled. Decisions regarding the details of when the system would be made operational, which sectors would be included, how initial permits would be allocated and so on will be intensely political.

KEY POINTS – AN AUSTRALIAN CARBON TRADING SYSTEM

- *The details of how carbon trading would work and how initial permits would be allocated are not yet clear. The most likely scenario is a 'cap and trade' model and initial allocation through a mix of 'grandfathering' and auctioning.*
- *It now seems unlikely that an Australian carbon trading system will be established before the start of the first Kyoto commitment period in 2008.*
- *Carbon trading would allow for trading of both permits to emit allocated under the Kyoto protocol and carbon credits generated through land management that increases carbon sinks.*
- *It is uncertain which land management activities will be recognised in international trading systems. To date only forestry activities are accepted.*
- *The AGO's mid-range estimate of the value of emission permits is $30 per tonne CO_2-e.*
- *High permit costs could seriously impact on some greenhouse intensive industries that have limited opportunity to cheaply reduce emissions.*
- *There are many uncertainties about carbon trading, including whether it happens and which industries will be excluded.*
- *Through one means or another, the threat of climate change is expected to lead to a 'carbon constrained economy'.*

6 POTENTIAL IMPACTS OF AUSTRALIAN GREENHOUSE POLICY ON RED MEAT PROCESSORS

It has been shown that Australia will have to work hard to achieve its Kyoto Protocol targets. These efforts, which are likely to include carbon trading, could significantly affect some parts of the Australian economy.

This chapter explores the potential impacts of Australia's emission reduction efforts on the red meat processing sector. To fully understand these impacts, it is necessary to consider not only the direct emissions from the abattoir, but also emissions from 'upstream' activities such as livestock production and the generation of electricity used in meat processing. This is because the effects of greenhouse policy (particularly carbon trading) on these off-site activities may, in turn, affect meat processors through costs and other influences.

The emissions from all activities in the chain from stock raising to delivery of meat to the wholesale market are therefore examined, rather than meat processing alone. This production chain is referred to as 'meat production'.

The chapter opens with an examination of the sources of emissions from meat production and their relative significance, showing that emissions from livestock raising are most significant.

It then looks at likely impacts of greenhouse policy on individual meat processors and on the industry collectively, and finds that there are potentially major impacts due to increases in livestock prices.

6.1 GREENHOUSE GAS EMISSIONS FROM RED MEAT PRODUCTION[11]

Emission estimates given in this section are calculated using:

- estimated meat processing emissions (including electricity) based on typical meat production, energy, fuel types and wastewater management profiles derived from a previous benchmarking study[12];
- emissions from livestock by type and age derived from National Greenhouse Gas Inventory Committee reports; and
- emissions from transport based on emissions per tonne per kilometre (t.km) and estimated figure for t.km of livestock transported.

6.1.1 Sources of emissions from meat production

Major sources and potential sources of greenhouse gas emissions from red meat production are:

- emissions from livestock (see Section 6.1.5);
- CO_2 from land management practices that release carbon from soil or cleared vegetation;
- CO_2 from direct combustion of fossil fuels in meat processing (for boilers etc);
- CO_2 from combustion of fossil fuels to generate electricity used in meat processing (refrigeration, pumping etc);

[11] An earlier report on the industry's greenhouse gas emissions was prepared by Bureau of Resource Sciences (BRS), Australian National University (ANU) and Australian Bureau of Agricultural and Resource Economics (ABARE) (1994) *Greenhouse Gas Emissions from Australian Beef and Sheepmeat Industries; on Farms, in Feedlots and in Transport and Meat Processing Facilities.* ABARE, Canberra.

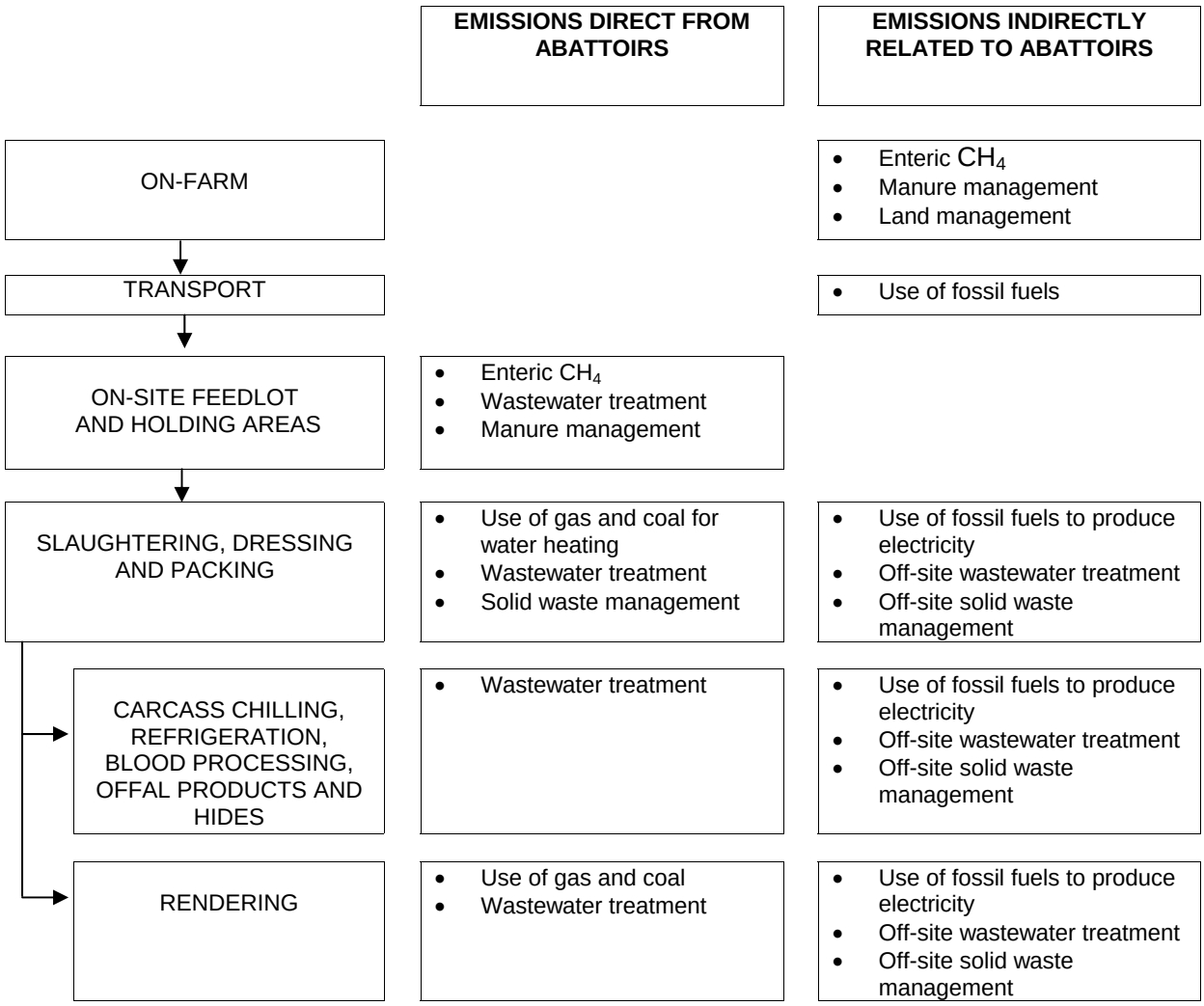
[12] MLA (1998) *Benchmarking of Environmental Performance*. Project RPDA.308, MLA, Sydney

- CH_4 from anaerobic decay of organic wastes from meat processing, either in solid waste or wastewater, and either on- or off-site; and
- CO_2 from combustion of fossil fuels used to transport stock and product.

Figure 3 shows the flow of materials through the meat processing production chain and relates the emission types given above to production activities. Emissions are categorised into direct emissions from meat processing and related indirect emissions.

Management options for reducing emissions from each of these categories are discussed in detail in Chapter 7

FIGURE 3: MAJOR SOURCES OF GREENHOUSE GAS EMISSIONS FROM MEAT PRODUCTION



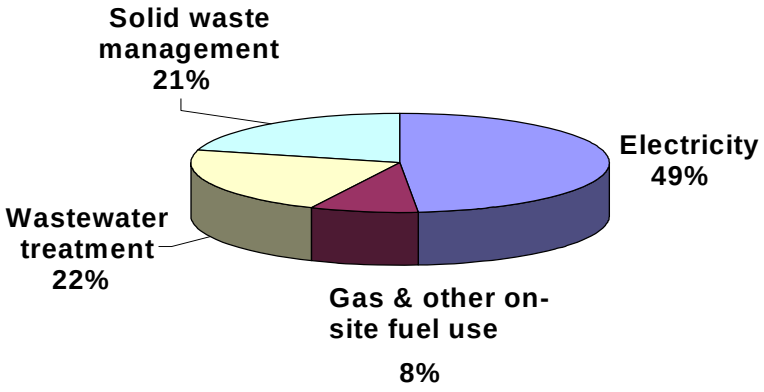
6.1.2 What are the most important sources of emissions from abattoir operations?

Figure 4 compares sources of emissions from abattoir operations. The comparison includes all direct and indirect emissions of meat processing shown in Figure 3, but excludes emissions from the farm, transport and on-site holding yards.

The figure is derived from estimates of the greenhouse intensity of processing of beef and sheep meat in terms of kg CO_2-e per unit of Hot Standard Carcass Weight (HSCW). HSCW was used as it reflects non-meat products such as hide, tallow, meal, etc obtained per head of animals processed. This is particularly important when the emissions from on-site rendering operations are considered, as it accounts for non meat products derived from carcasses.

The estimated emissions from wastewater and solid waste treatment are based on their potential for these wastes to generate CH_4 under anaerobic conditions. Aerobic management of waste will reduce or eliminate these emissions but is often achieved through mechanical aeration, adding to energy consumption.

FIGURE 4: RELATIVE GREENHOUSE SIGNIFICANCE OF EMISSIONS FROM ABATTOIR OPERATIONS (kg CO_2-e/kg HSCW).



It can be seen that electricity is typically the greatest source of meat processing emissions but waste management is also important. Direct use of fuel is of lesser importance.

Figure 5 breaks down electricity consumption by on-site process, showing the average distribution of power use across different processing activities. Chilling and refrigeration activities are seen to be the highest uses of electrical energy within the sector, accounting for almost 60% of consumption. Other areas of significant consumption are boiler rooms, rendering and slaughter areas. Actions to reduce greenhouse emissions from meat production should therefore focus on improving refrigeration and chilling efficiencies.

FIGURE 5: ELECTRICAL ENERGY CONSUMPTION IN MEAT PROCESSING

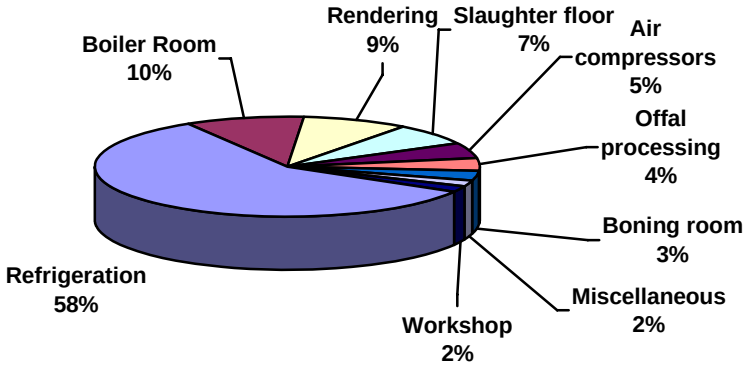
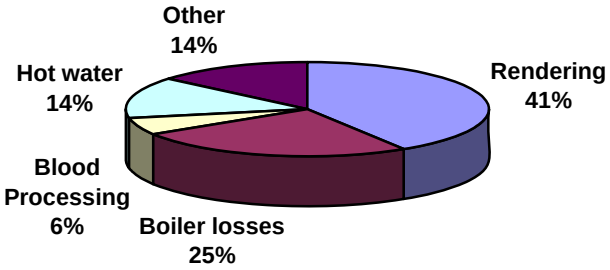


Figure 6 breaks down direct use of fossil fuels by on-site process, showing the average distribution of direct energy use across different processing activities. It can be seen that energy losses from boilers are second only to energy use in rendering, suggesting that the best opportunities for reducing emissions are heat conservation from boilers, rendering operations and hot water use within abattoirs.

FIGURE 6: ABATTOIR FUEL CONSUMPTION BY PROCESS



Previous studies have demonstrated that larger abattoirs can achieve greater energy efficiencies than smaller 'kill and chill' facilities because larger abattoirs:

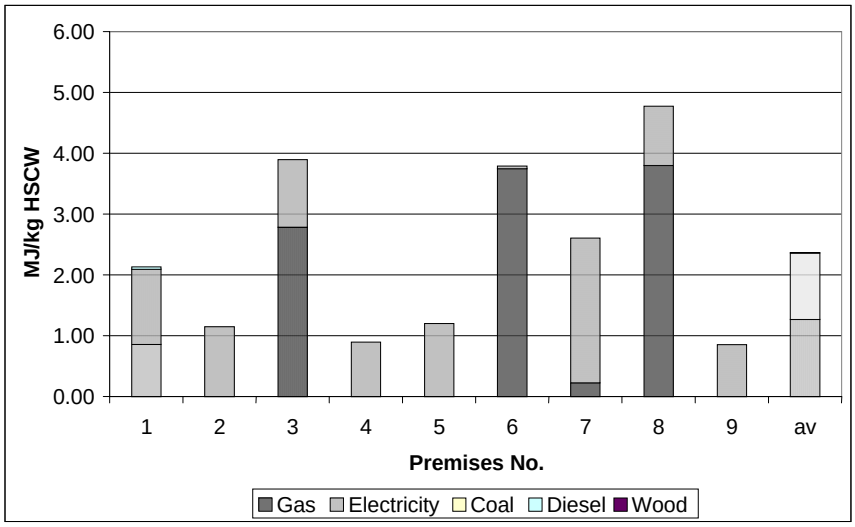
- have sufficient economies of scale to support integration of facilities;
- can use heat from ancillary activities such as rendering and offal products processing to heat water for dressing carcasses; and
- have economies of scale that shorten pay back periods for investment in energy-conserving technologies.

6.1.3 Variation between abattoirs

The benchmarking study[13] revealed considerable variation in energy demand and fuel type use in abattoirs. Figure 7 shows sources of energy per kg HSCW at nine facilities. It can be seen that some facilities rely almost entirely on electricity for processing energy, whilst others (typically those with rendering operations) rely more on gas. Other fuels are relatively unimportant. On average, gas is used more than electricity.

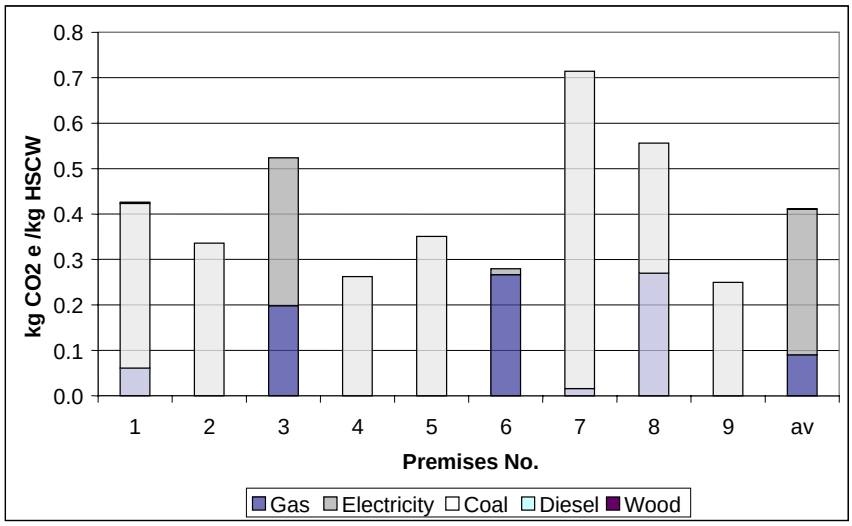
[13] MLA (1998) *Benchmarking of Environmental Performance*. Project RPDA.308, MLA, Sydney

FIGURE 7: ENERGY INTENSITY AND SOURCES AT SELECTED ABATTOIRS



Different fuels and energy sources give rise to different greenhouse emissions per unit of energy. Figure 8 shows the greenhouse emissions per unit meat processed at the premises shown in Figure 7. The data were calculated using national averages for emissions from electricity generation[14]. Figure 8 shows that electricity is the most significant source of emissions from processing at all abattoirs except one that relied almost entirely on gas (premises 6). Emissions from coal and diesel were not significant on a per unit HSCW basis. Emissions from burning wood from sustainably managed forests are generally not considered to contribute to the anthropogenic greenhouse effect as these are part of the natural carbon cycle.

FIGURE 8: GREENHOUSE INTENSITY AND SOURCES AT SELECTED ABATTOIRS



[14] Actual emissions from electricity generation (and therefore potential cost increases due to carbon trading) vary according to the fuel type used to generate electricity, but due to national competition the cost of carbon trading is likely to be spread across the power sector with a movement over time towards less greenhouse intensive fuels. It is therefore considered legitimate to use an average figure for emissions from electricity.

6.1.4 What are the most important sources of emissions from the whole meat production chain?

The previous sections have examined and compared the emissions from meat processing, including on-site use of fossil fuels, on-site electricity use and waste management. It was shown that electricity use and waste management are generally most significant. In this section the emissions from meat processing are more broadly compared with those from other components of the meat production system.

Modelling was conducted to estimate relative emissions from on-farm, transport and processing emissions. This used indicative figures for:

- emissions from livestock;
- sale weights;
- energy consumption and waste generation per unit of product;
- emissions factors for different energy types; and
- typical transport distances.

Potential emissions or sequestration from land management activities are not included (see Box 7).

Figure 9 breaks down the emissions by source for a whole meat production chain.

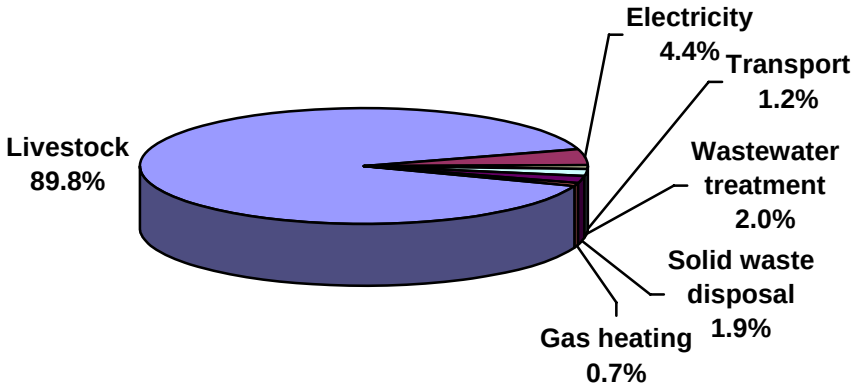
Box 7: Possible credits and liabilities from land management

As discussed in Section 5.3.2, soils and vegetation act as carbon sinks, and changes in the size of these sinks due to land management affect net carbon emissions.

The livestock emission estimates given in this report do not account for these carbon sink changes as too little is know about their extent, their management and how they will be affected by the Kyoto Protocol and carbon trading.

However, livestock managers need to be aware that their land management affects greenhouse fluxes. Increasing the size of sinks could yield carbon credits. Conversely, land clearing and overstocking may create a greenhouse liability.

FIGURE 9: INDICATIVE CONTRIBUTIONS OF EMISSION SOURCES FROM MEAT PRODUCTION AND PROCESSING (for a 24 month steer)



Clearly, emissions from livestock dominate, contributing almost 90% of the total. The 'direct' emissions from energy use and waste management from meat processing, including electricity, add up to a mere 9% of the total. Transport emissions are also relatively small, but they can be much larger where transport distances are high.

For a typical abattoir that runs its own on-site feedlot, livestock emissions are likely to form the bulk of the emissions from the facility if the stock holding time exceeds five weeks.

The dominance of livestock emissions means that if carbon trading is applied to a wide range of sources, including on-farm emissions, the greatest cost impost on meat processors would most likely be the increased cost of livestock purchasing and finishing. Sources of livestock emissions and the relative contribution of different types of animal are now discussed.

6.1.5 Sources of emissions from livestock

It has been shown that on-farm emissions from livestock are the most significant source of greenhouse gas from meat production and processing.

Greenhouse emissions from livestock are of three types:

- CH_4 from 'enteric fermentation' – the process of digestion in ruminant animals which leads to emissions through belching and exhalation;
- CH_4 from anaerobic decay of faeces, mainly in feedlots; and
- N_2O arising from faeces and urine.

Table 1 shows the estimated greenhouse impacts of different types of livestock in Australia, broken into the three categories above. Clearly, the great majority of emissions arise from enteric CH_4 from cattle and sheep.

Box 8: Aren't livestock emissions natural?

In accordance with international standards, Australia's National Greenhouse Gas Inventory accounts for all greenhouse gas emissions and removals due to human activity. It is possible to argue about which emissions are due to human activity and which are not – for example, could emissions from animals be considered 'natural'?

Enteric emissions would have occurred long before human agriculture, but at far lower levels than now – particularly in Australia where ruminants were not introduced until European settlement. It therefore makes sense to count these emissions as human-induced and to target them in emission reduction programs.

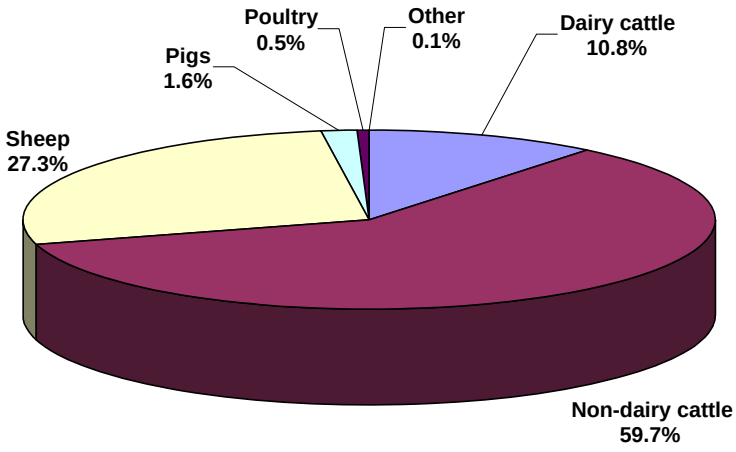
Figure 10 shows that beef and sheep production (excluding dairy cattle) are responsible for about 87% of Australia's livestock emissions. This means that beef and sheep meat production, including processing, are responsible for some 15-16% of national greenhouse gas emissions, and are therefore almost certain to be targeted by national and state greenhouse abatement efforts.

TABLE 1: GREENHOUSE EMISSIONS FROM VARIOUS LIVESTOCK TYPES

	CH_4 from enteric fermentation	CH_4 from faeces	N_2O due to animal faeces, urine & manure	**Total emissions per animal**	No. of animals in Australia	**Total emissions from all animals**	% of all emissions from livestock
	kg CO2-e / head / year					*t CO_2-e /year*	
Dairy cattle	2245	168	149	**2562**	2,931,000	**7,509,222**	10.8%
Non-dairy cattle	1552	0.42	64	**1616**	25,765,000	**41,636,240**	59.7%
Sheep	140	0	9	**149**	127,865,000	**19,051,885**	27.3%
Pigs	23	379	17	**419**	2,583,000	**1,082,277**	1.6%
Poultry	0	2.5	2	**4.5**	77,250,000	**347,625**	0.5%
Buffalo	1155	n.a.	n.a.	**1155**	9,000	**10,395**	0.0%
Goats	105	n.a.	n.a.	**105**	105,000	**11,025**	0.0%
Camels	966	n.a.	n.a.	**966**	1,000	**966**	0.0%
Horses	378	n.a.	n.a.	**378**	135,000	**51,030**	0.1%
Donkeys/mules	210	n.a.	n.a.	**210**	n.a.	**-**	-

n.a. = not available. There would be some relatively minor emissions from these sources
Source: derived from AGO (1999) *National Greenhouse Gas Inventory 1997*: pp.93-97, 99-100.

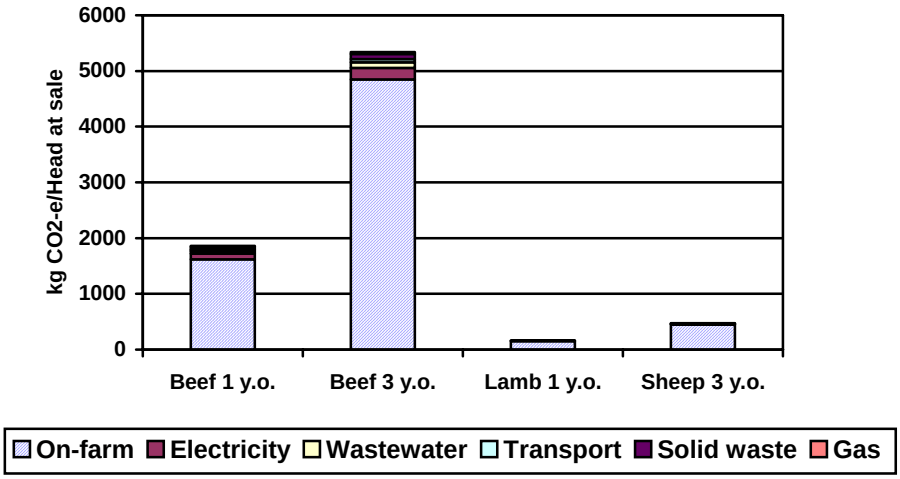
FIGURE 10: RELATIVE EMISSIONS FROM DIFFERENT LIVESTOCK IN AUSTRALIA



6.1.6 Greenhouse intensities of different livestock and meat types

The size and age of animals will affect their relative contribution to on-farm emissions. Figure 11 shows the total emissions from meat production for ruminants of different ages. Cattle and older animals have higher impacts because they produce more on-farm CH_4 emissions during their lives.

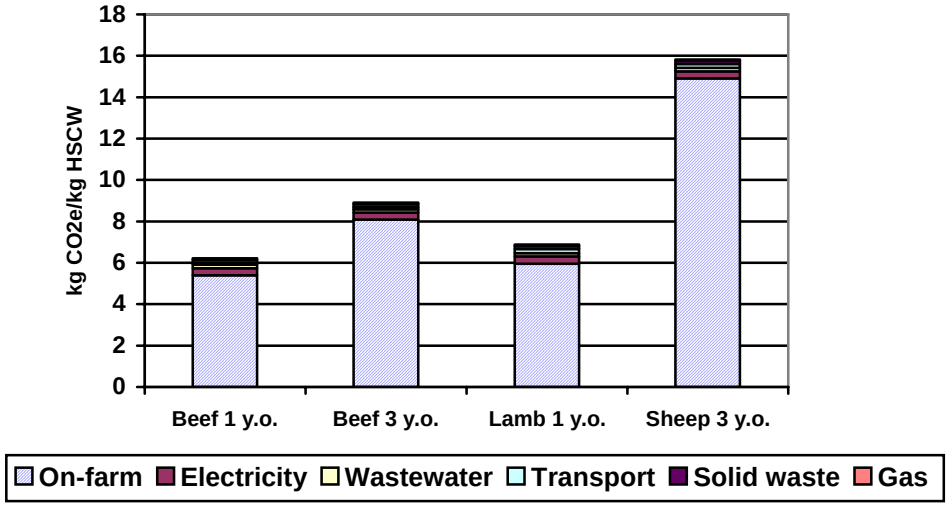
FIGURE 11: ESTIMATED GREENHOUSE EMISSIONS FROM PRODUCTION OF BEEF AND SHEEP MEAT OF DIFFERENT AGE CLASSES (kg CO_2-e/head at sale)



The greenhouse intensity of meat (emissions per unit of product) would determine the upward pressure on meat price if emissions trading were applied to emissions from livestock.

The greenhouse intensity of meat depends on the age and size (i.e. growth rate) of animals. Figure 12 compares the greenhouse intensity of various meats. This shows that the greenhouse intensity of meat increases with the age of the animal, mainly due to decline in live weight gain when animals reach maturity. The difference between younger and older animals is more marked in sheep because they typically attain adult weight more quickly than beef. The figure also demonstrates that the relative contribution of on-farm emissions increase as animals age, implying that increasing growth rates and killing animals earlier may reduce greenhouse influenced cost increases.

FIGURE 12: ESTIMATED GREENHOUSE EMISSIONS FROM PRODUCTION OF BEEF AND SHEEP MEAT OF DIFFERENT AGE CLASSES (kg CO_2-e/kg HSCW at sale)



KEY POINTS – GREENHOUSE GAS EMISSIONS FROM MEAT PRODUCTION

- *Greenhouse gases are emitted at various points in the meat production chain including from livestock raising, from some land management practices, from use of fossil fuels in processing works, from the generation of electricity used in processing works, from anaerobic decay of organic wastes and from transport of stock and product.*
- *Little is known about the extent of credits or liabilities from the greenhouse impacts of land management, how these impacts should be managed, and how they will be dealt with by the Kyoto Protocol and carbon trading systems.*
- *Although the sources of processing energy vary from site to site, electricity consumption generally dominates processing emissions. Waste management can also be significant. Transport emissions are generally somewhat less important except where stock are transported long distances.*
- *The processes generally consuming the most processing electricity are chilling and refrigeration. The processes generally consuming the most processing fuel are rendering and boiler losses.*
- *Livestock emissions are the most significant source of emissions from the meat production chain, contributing in the order of 90% of emissions (ignoring potential emissions and sequestration from land management practices).*
- *For a typical abattoir that runs its own on-site feedlot, livestock emissions are likely to form the bulk of the emissions from the facility if the stock holding time exceeds five weeks.*
- *The major source of emissions from livestock is CH_4 from enteric fermentation. Non-dairy cattle and sheep produce almost 90% of all emissions from livestock.*
- *Meat from younger and faster growing animals has lower greenhouse emission intensity.*

6.2 HOW WILL GREENHOUSE POLICY AFFECT INDIVIDUAL MEAT PROCESSORS?

6.2.1 The impact of carbon trading on meat processors' costs

If carbon trading is established, meat processors could be affected by:

- the cost of purchasing permits and attendant administration; and
- increased costs due to the impact of carbon trading on suppliers and allied industries.

As discussed in Section 5.3.6, the market value of carbon permits is unclear. The following assessment considers a range of permit values of between $5 and $50 per tonne CO_2-e. It also considers costs to processors if only fossil fuel emissions are included in emissions trading, and compares this to the situation where on-farm livestock emissions are included.

6.2.2 Carbon trading administration and compliance costs

Depending on the final structure of any carbon trading system, processors may need to participate directly in the trading system. This means:

- purchasing permits to acquit emissions;
- monitoring or calculating emissions; and
- associated administrative tasks.

Setting up these additional functions would involve some cost to meat processors but ongoing management costs would be small relative to the potential cost of permit purchasing.

It is possible that the requirement to acquit emissions will be restricted to 'upstream' sources such as energy suppliers and waste managers, meaning that meat processors would be entirely freed from the administrative requirements of carbon trading.

6.2.3 The impact of carbon trading on processing and transport costs

If emissions trading is applied to fossil fuel emissions and the increased costs are directly handed on to consumers of fossil fuel and fossil fuel derived electricity, meat processors will have to pay for emissions from transport, electricity use, and on-site coal, gas and other fuel consumption. This is a plausible scenario as fossil fuel energy is the major focus of greenhouse abatement measures, including emission trading. Emissions from anaerobic management of wastewater and solid wastes could also be included in an emissions trading system, particularly if wastes from meat processors are treated or disposed at large municipal wastewater treatment or landfill facilities.

Table 2 shows estimated costs of emissions trading associated with meat processing if it were applied to fossil fuel energy consumption and waste management. The cost figures are based on a range of possible permit prices. A mid-range $30 per tonne of CO_2 equivalent is highlighted.

This assessment suggests that the costs of emissions trading for these sources of emissions could add in the order of 1 to 10 cents per kg to the cost of meat. Note that emissions from livestock are not included.

TABLE 2: ESTIMATED COST IMPACTS OF CARBON TRADING AT DIFFERENT VALUES OF TRADABLE PERMIT – EMISSIONS FROM PROCESSING

Activity	Greenhouse intensity (kg CO_2-e/kg HSCW)	Cost (cents/kg HSCW) if carbon permits valued at $/t CO_2-e		
		$5	***$30***	$50
Transport	0.15	0.08¢	**0.45¢**	0.75¢
Electricity	0.35	0.18¢	**1.05¢**	1.75¢
Gas	0.06	0.03¢	**0.18¢**	0.30¢
Wastewater	0.16	0.08¢	**0.48¢**	0.80¢
Solid waste	0.15	0.08¢	**0.45¢**	0.75¢
Total	**1.93**	**0.97¢**	**5.79¢**	**9.65¢**

NB: Figures in the column for $30 are highlighted to indicate that $30 per tonne CO_2-e is an estimated mid-range value for tradable emissions permits

The greatest contributors to cost increases are electricity consumption, waste management and transport. These additional costs could be significant, but are much lower than if livestock emissions are also required to be included in the trading system.

6.2.4 The impact of carbon trading on livestock costs

It has been shown that the most significant greenhouse gas source from meat production is livestock. The application of carbon trading to livestock emissions could cause very large increases in the price of stock. This is now considered.

Sensitivity analysis was undertaken to determine the permit costs for livestock under a range of possible unit values for carbon emission permits and for different ages of livestock. The results are summarised in Tables 3 and 4. It is assumed that all of the emissions costs would be passed on to the meat processor. (This may not be the case because the producers of other products from livestock – wool, hides, milk, etc. – could be expected to bear some of the emissions costs. This is discussed in section 6.2.6.

TABLE 3: ESTIMATED COST IMPACTS OF CARBON TRADING AT DIFFERENT VALUES OF TRADABLE PERMIT - CATTLE

Stock	Unit	Costs of carbon permits at different values of $/tonne CO_2-e				Indicative current market value of stock
		$5	$10	**$30**	$50	
Steers 1 yr	$/hd	$ 8.08	$ 16.16	**$ 48.48**	$ 80.80	$600
	$/kg HSCW	$ 0.03	$ 0.06	**$ 0.19**	$ 0.32	
Cows 5 yrs	$/hd	$ 40.40	$ 80.80	**$ 242.40**	$ 404.00	$550
	$/kg HSCW	$ 0.10	$ 0.20	**$ 0.61**	$ 1.01	

NB: Figures for costs per kg assume that emissions costs are entirely paid by meat processors. Milk and hides may be able to absorb some of the costs.

TABLE 4: ESTIMATED COST IMPACTS OF CARBON TRADING AT DIFFERENT VALUES OF TRADABLE PERMIT - SHEEP

Stock	Unit	Costs for carbon permits at different values of $/tonne CO_2-e				Indicative current market value of stock
		$5	$10	**$30**	$50	
Lamb 1 year	$/hd	$ 0.75	$ 1.49	**$ 4.47**	$ 7.45	$ 20
	$/kg	$ 0.03	$ 0.07	**$ 0.18**	$ 0.30	
Sheep 5 year	$/hd	$ 3.73	$ 7.45	**$ 22.35**	$ 37.25	$ 20
	$/kg	$ 0.12	$ 0.25	**$ 0.75**	$ 1.24	

NB: Figures for *costs per kg assume that emissions costs are entirely paid by meat processors. Wool and skins may be able to absorb some of the costs.*

This analysis shows that, even at the low end of the expected value range for carbon emission permits ($5.00/t CO_2-e), the cost of producing beef and sheep meat can be expected to rise some 3 to 12 cents per kg HSCW depending on the age of the source animal and the extent to which other products from livestock bear the costs of emissions. At the mid range figure of $30/t CO2-e, costs can be expected to rise by 18 to 75 cents per kg HSCW.

As a proportion of market value of stock, increases in costs will be felt most keenly by sellers of older animals. In the case of cows and sheep, these costs will be partially off-set by the sale of milk and wool respectively (see section 6.2.6) and the sale of off-spring. However, for other livestock there will be incentive to turn off animals at a younger age. This implies improving growth rates and feed conversion in younger animals.

Note that these cost ranges do not account for the administration costs of accounting for on-farm emissions for the purpose of 'acquittal' of emissions. Administration costs would also be passed on to purchasers of farm product. The costs of monitoring and verifying could be high due to the large numbers of factors affecting emissions and properties to be 'policed'.

6.2.5 The overall impact of carbon trading on profit margins

The operating costs of processors vary widely and meat prices fluctuate seasonally. Processors interviewed as part of the current study indicated that margins for sheep processing were at the time of interview typically under 10 cents per kg HSCW, and a 1996 study[15] of the costs of meat production found that margins periodically fall to less than 1 cent per kg HSCW. It can be assumed that meat processor's margins typically remain below 25 cents per kg HSCW, and are often below 10 cents for kg HSCW. This is less than the predicted mid-range cost increase predicted under carbon trading using current emission levels.

The cost of administration and compliance is likely to be minor. Increases in processing and transport energy costs could be significant where margins are particularly low.

If livestock emissions were included in carbon trading, however, the effect on costs could be dramatic and could more than wipe out current profit margins. Increases to consumer prices could be necessary to maintain the viability of Australian meat producers.

[15] MRC (1996) *The value chain for meat and livestock products*, AACM International Pty Ltd, Adelaide SA.

Note that livestock emissions levels can be reduced or offset by a variety of measures (as discussed in Section 7), and these could substantially reduce the greenhouse liability of meat producers.

6.2.6 The impact of carbon trading on the cost of other livestock products

The above assessment of the potential costs of carbon trading on livestock purchases and HSCW did not consider the extent to which the costs of emissions trading (if it were applied to livestock) would be shared by the producers of other livestock products.

Major non-meat products from beef cattle are:

- hides and rendered products; and
- milk and offspring from dairy cattle.

According to a previous study[15], hides contribute less than 6% of the value of products from cattle[15], suggesting that tannery operations could absorb only a small portion of carbon trading costs.

Milk sales were estimated to contribute in the order of 26% of the Australian livestock industry's income although the dairy herd makes about 10% of the total cattle numbers. It is therefore possible that virtually all carbon emissions costs of beef sourced from the dairy sector could be absorbed by the sale of dairy products.

In the case of sheep and lamb production, meat can be seen as a co-product of wool, the latter contributing in the order of 45% or more of the total value products from sheep. This implies that a large portion of carbon emissions costs could be absorbed by the sale of wool.

The extent to which the costs of carbon trading can be borne by non-meat products will depend on the ability of the producers and processors of these products to pass on costs to consumers. Table 5 shows estimated cost increases of livestock products if emissions costs were levied entirely on the producer of that product. The figures presented in this table represent the 'worst case" scenario for each product, and it is unlikely that one product would need to bear the entire costs of carbon trading. The figures are presented to show the relative ability of different products to bear the costs of emissions trading. The figures show that the costs of carbon trading could have:

- a very large impact on the cost of producing hides/skins from all stock, but particularly older animals; and
- a very large impact on the cost of producing lambs' wool, and a lesser but significant increase on wool from older sheep.

On the basis of this assessment, and subject to market demand elasticity, it is likely that products such as hides and lambs wool would be less able to would be less able to absorb costs of carbon trading that meat (particularly meat from younger animals). Wool form more mature sheep would be able to absorb carbon trading costs more readily than meat from the same animals. Milk (and presumably other dairy products) may be able to absorb most of the costs of emissions trading from dairy herds.

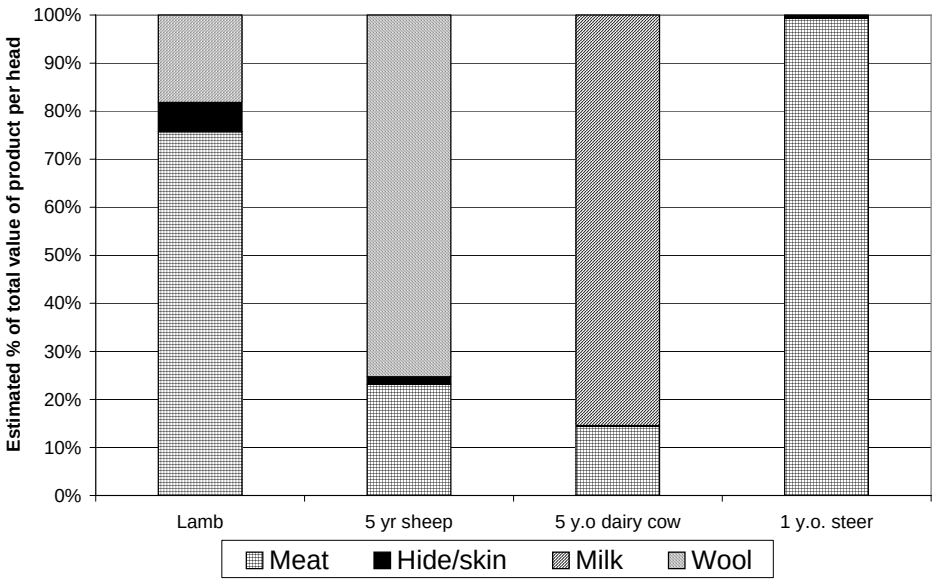
TABLE 5 ESTIMATED "WORST CASE" SCEANARIO COST IMPACTS OF CARBON TRADING AT DIFFERENT VALUES OF TRADABLE PERMIT – VARIOUS ANIMAL PRODUCTS (ASSUMING EACH BEARS THE TOTAL COST INCREASE OF CARBON TRADING)

Product	Product per head	Emissions /head	Emissions per unit of product	Costs for carbon permits ($/unit) at different values of $/tonne CO2-e if the product incurred 100% of carbon permit costs				Indicative price at farm gate /market. $/unit #
				$5	$10	$30	$50	
Lamb								
Wool (greasy)	2 kg/yr	149	74.5	$0.37	$0.75	$2.24	$3.73	$ 3.00
Hide/skin	1 Hide	149	149	$0.75	$1.49	$4.47	$7.45	$ 2.00
Meat	25 kg HSCW	149	5.96	$0.03	$0.06	$0.18	$0.30	$ 1.00
Sheep - 5 year								
Wool	6.5 kg/yr	149	22.9	$0.11	$0.23	$0.69	$1.15	$ 3.00
Hide/skin	1 Hide	745	745	$3.73	$7.45	$22.35	$37.25	$ 2.00
Meat	30 kg HSCW	745	24.8	$0.12	$0.25	$0.75	$1.24	$ 1.00
Dairy cattle - 5 year								
Milk	4740 L/yr	2,562	0.54	$0.00	$0.01	$0.02	$0.03	$ 0.15
Hide	1 Hide	12,810	12810	$64.05	$128.10	$384.30	$640.50	$ 6.00
Meat	400 kg HSCW	12,810	32.03	$0.16	$0.32	$0.96	$1.60	$ 1.50
Steer - 1 year								
Hide	1 Hide	1,616	1616	$8.08	$16.16	$48.48	$80.80	$ 6.00
Meat	250 kg HSCW	1,616	4.04	$0.03	$0.06	$0.19	$0.32	$ 2.00

 # Indicative prices obtained from Stock and Land newspaper market price listings

Figure 13 shows the relative contribution of different products to the total productive value of different livestock.

FIGURE 13: ESTIMATED RELATIVE CONTRIBUTIONS OF MEAT AND NON-MEAT PRODUCTS TO THE VALUE OF TOTAL PRODUCTION DERIVED PER HEAD OF STOCK.



This assessment suggests that under a carbon trading system applied to emissions from livestock, meat processors would be likely to bear:

- most of the carbon emissions costs of lamb and beef cattle production; and
- a lower proportion of emissions costs for meat from dairy cattle and sheep (the actual portion will depending on the ages of the animals – in the case of prime lamb production, meat processors could expect to bear most of the costs).

Purchasers of hides could be expected to bear a very small portion of emissions trading costs.

Tanneries, dairy processors and meat processors are all price takers, and the extent to which they could absorb price increases and pass them on to consumers is limited. It is possible that wool, milk and leather producers would be able to absorb higher proportions of carbon trading costs through value-adding to products, reducing the burden on meat processors.

6.2.7 Which emissions from meat production are likely to be included in carbon trading?

Criteria for excluding a sector or activity from a carbon trading system were presented in Section 5.3.4.

The main source of emissions from meat production – livestock - is a good candidate for exclusion from carbon trading, readily satisfying several of the criteria shown. Measuring and verifying emissions on a farm-by-farm basis would be very difficult and expensive, requiring complex accreditation systems and high level supervision to check site conditions and management processes. This cost would be added to the potentially prohibitive cost of emission permits themselves. Perhaps most important, the social consequences of these high costs could themselves be severe, deeply affecting the lives of operators and their communities. It seems unlikely that any government would risk the political repercussions of any such policy.

Despite the potential costs, there may be stiff resistance from many operators to excluding livestock (and agriculture generally) if that means farmers are unable to sell carbon credits generated through enhancement of carbon sinks on their property – and it would be difficult for government to exclude emissions but include credits.

Including emissions from waste management in a carbon trading system would also be problematic due to difficulties with measurement and verification. Inclusion of emissions from the use of energy, on the other hand, should be expected. This would lead to higher prices for gas, coal, power and diesel.

6.2.8 What if livestock emissions are excluded from carbon trading or if no carbon trading system is established?

As discussed in previous sections, it is distinctly possible both that livestock emissions are excluded from carbon trading and also that no carbon trading system is ever established in Australia. However, as a major emitter of greenhouse gases there is no chance of the meat production industry being ignored by policy makers. Any approach seen as too ‘soft’ on the agricultural sector is likely to bring strong protests from other industries claiming to be carrying an unfair share of the burden of Australia’s commitments.

Efforts to reduce greenhouse gas emissions from energy consumption may include improved incentives and an intensification of current programs and policies.

Possible alternatives to full inclusion of livestock in a carbon trading system include a mix of:

- promotion and education[16];
- mandated and government supported take up levels of management practices that reduce emissions (see Section 7);
- mandated emission reduction targets;
- an agriculture-specific carbon trading system with a somewhat less onerous 'cap' or a 'baseline and credits' structure;
- buy-out of particularly emission intensive operations;
- partial inclusion in carbon trading, perhaps at a subsidised rate; and/or
- phased inclusion in carbon trading over more than one commitment period.

Whether or not carbon trading is established and whether or not it includes livestock emissions, greenhouse policy is likely to change the economics of meat production and to detrimentally affect broad-scale livestock producers in particular.

Industry-wide impacts are considered in the following section.

KEY POINTS – HOW WILL GREENHOUSE POLICY AFFECT INDIVIDUAL MEAT PROCESSORS?

- *If carbon trading is established, meat processors will face administration and compliance costs, but these are likely to be minor.*
- *A carbon trading system applied to the emissions from consumption of fossil fuels and from anaerobic decay of waste could increase processing and transport costs by 1 to 10 cents per kg HSCW.*
- *If livestock emissions are included in carbon trading, the effect on costs could be dramatic and could more than wipe out current profit margins. Increases to consumer prices could be necessary to maintain the viability of Australian meat producers.*
- *Producers of non-meat livestock products – particularly wool, milk and leather producers – should be able to share some of the costs of carbon emissions trading.*
- *Livestock emissions are a good candidate for exclusion from carbon trading due to technical, administrative, social and political costs. However, it would be difficult for government to exclude emissions while still allowing farmers to generate and sell carbon credits.*
- *It is distinctly possible both that livestock emissions are excluded from carbon trading and also that no carbon trading system is ever established in Australia. However, as a major emitter of greenhouse gases there is no chance of the industry being ignored by policy makers. Greenhouse policy is likely to change the economics of meat production and to detrimentally affect broad-scale livestock producers in particular.*

[16] AGO has already started a promotion and education program for livestock farmers.

6.3 HOW WILL GREENHOUSE POLICY AFFECT THE MEAT PROCESSING INDUSTRY AS A WHOLE?

6.3.1 Impacts on livestock production

It has been shown that Australian greenhouse policy responses could affect meat processors in a number of ways, most importantly through its impact on livestock production.

Table 6 compares the greenhouse intensity per dollar value of product for various Australian industries, and shows that under current scenarios for CH_4 emissions from enteric fermentation, cattle and sheep meat production are among Australia's most greenhouse gas intensive industries per dollar output. This means that livestock owners would need more emission permits per unit of financial return than many other industries. In a free market for permits, livestock owners would find it difficult to compete in bidding for the right to emit. Non-ferrous and ferrous metals producers, for example, are high greenhouse emitters and have limited opportunities to reduce emissions, and so may be highly competitive in purchasing permits. Other highly greenhouse intensive industries such as electricity suppliers will have strong incentives to move to less greenhouse intensive fuels such as natural gas and bio-mass. However, the demand for electricity is less elastic than the demand for meat – electricity consumption is not as easily substituted for by other energy sources as red-meat can be substituted for by other meats and non-meat products. In other words, an increase in the price of electricity could be more readily handed on to consumers (who have limited opportunity to reduce power consumption) than can an increase in the price of red-meat which would most probably result in many consumers purchasing substitute products.

TABLE 6: A COMPARISON OF THE GREENHOUSE INTENSITY OF THE MEAT INDUSTRY AND OTHER SIGNIFICANT SECTORS[17]

Industry	**Greenhouse Intensity** *(kg CO_2-e /AU$ of product)*
Electricity generation	12.3
Agriculture	11.1
Meat and meat products	**6.4**
Milk and milk products	6.2
Basic non-ferrous metals	3.4
Basic iron and steel	3.3
Textiles, clothing and footwear	2.6
Cement and glass	2.5
Wood and wood products	1.6
Road transport	1.1

Even if permits were initially 'grandfathered' to livestock owners at no cost, many farmers would be tempted to sell the permits to other industries where the right to emit is more valuable. The potential for landowners to de-stock, convert land to plantations and then sell both their livestock emission permits and carbon credits for plantation timber may provide strong incentives for landowners to move out of meat production. It may also be possible for governments wishing to achieve greenhouse emissions reductions to buy out or fail to renew pastoral leases in order to reduce emissions from ruminant production.

[17] Lenzen M (1998) Primary energy and greenhouse gases embodies in Australian final consumption: an input-output analysis. *Energy Policy* **26** no.6 pp.495-506.

Greenhouse policy may therefore cause a reduction in broadscale livestock farming.

As discussed in section 6.2.6, complementary animal products such as dairy products, wool and hides will also be affected by carbon trading-induced cost increases. To varying degrees, the producers and manufacturers will be able to share some of the carbon emissions costs. However, like meat, these products are strongly exposed to export markets and can be substituted for alternatives (e.g. vegetable oils, synthetic fibres) and are therefore subject to pressures similar to those facing meat producers. Impacts on the costs of these products could result in flow-on effects to livestock and meat prices. For example, large increases in the cost of wool could further reduce the viability of wool production. This in turn would result in a reduction in the national sheep herd numbers and result in a longer-term increase in lamb and sheep prices due to reduced supply.

6.3.2 Regional variation

The impacts of greenhouse policy will vary between different types of livestock producers. Those able to reduce their emissions relatively cheaply (generally intensive and efficient growers – see Section 7.3) could gain substantial advantage over those that cannot.

In lower productivity dry areas, weight gains are slower due to poor quality feed, so animals emit CH_4 over a longer time period and there is a higher greenhouse impact per unit meat. There are also fewer opportunities for reducing emissions in broad-acre systems (see Section 7.3). In addition, transport distances from these areas tend to be high, so they are likely to be affected by increases in fuel costs due to carbon trading.

Greenhouse policy is therefore likely to encourage a shift towards intensive production such as feedlots from less intensive and less efficient broad-acre operations (unless these are able to compensate for their emissions by producing carbon sinks by increasing plantations and stored carbon in soil). Greenhouse policies that enhance the value of stored carbon in vegetation are also likely to significantly slow land clearing and the expansion of grazing land.

Livestock producers in lower productivity arid and semi-arid pastoral areas such as the Northern Territory, Western Australia and inland South Australia, Queensland, and NSW are most threatened by adverse effects of greenhouse policy.

Areas with more reliable and higher quality supply of feed (so that stock can maintain growth rather than simply maintain body weights for part of the year) will be more able to meet the challenge of reducing greenhouse impacts per unit of product. However, the wood and wood products sector may also become more aggressive in competing for land to grow timber for carbon credits, increasing land prices in higher rainfall areas.

Due to a lack of available information it has not been possible to establish state by state benchmarks for the sector. It is recommended that detailed data collection commence so that the livestock industry is able to demonstrate actual emissions and reductions over time. The industry could also support research to quantify the ability of improved land management practice to increase stored carbon in soil and vegetation, with the objective of such land management being recognised under emission trading systems. If improved land management is recognised and landowners can acquit greenhouse reductions against credited stored carbon, then some livestock emissions may

be offset through land management practices that maintain and improve the feed base.

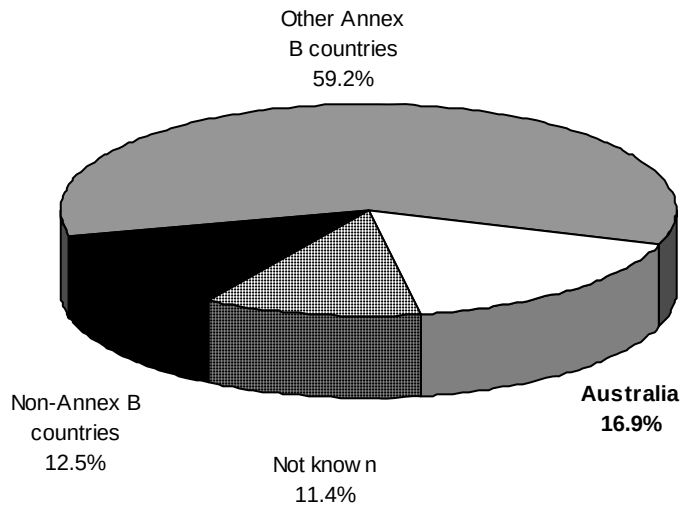
6.3.3 Impacts on demand for Australian red meat

If, as expected, Australian greenhouse policy causes meat production input costs to increase, the industry would probably need to recoup some or all of this by increasing meat prices. Demand for meat is generally thought to be price sensitive, so this could affect Australian meat consumption by diverting demand to other sources or to alternative products. Since around half of Australia's meat production is exported and the other half supplies almost all domestic needs, changes in both export and domestic demand need to be examined.

Figure 14 shows that over 75% of global meat exports in 1999 were from signatories to the Kyoto Protocol (Annex B countries). Meat industries in each country will be similarly burdened by pressure to reduce emissions and a high emission intensity per dollar of production. However, countries practicing more intensive livestock production have cheaper opportunities to reduce livestock emissions per unit production and may be less disadvantaged by greenhouse emission abatement requirements. In addition, government support for emission abatement measures is more affordable in countries where the sector is relatively small. Australia is therefore likely to be somewhat disadvantaged by its relatively large and broad-acre based livestock production industry.

At least 13% of 1999 world meat exports were from non-Annex B countries that do not face the cost of mandatory emission reduction policies. These exporters, mainly the large South American producers, will derive some competitive advantage if Protocol signatory countries need to raise prices. Many of these countries are also currently involved in beef herd number building to meet rising international demand for beef. Argentina, however, has indicated it will voluntarily cap its emissions – this may force its meat producers to adopt emission abatement measures.

FIGURE 14: GLOBAL MEAT EXPORTS, 1999



Source: MLA (1999) *Meat and Livestock Statistical Review, July 1998 – June 1999.*

The elasticity of demand for individual types of meat can, in part, be attributed to the ability of consumers to choose cheaper cuts of substitute meat products if the price of one type of meat rises. It is often argued, for example, that the shift in Australian meat consumption from red meat to chicken is, at least in part, driven by increasing price differentials due to efficiency gains in poultry farming.

Such differences may be exacerbated by carbon trading and/or other greenhouse abatement initiatives. Table 7 compares the estimated greenhouse gas emissions per unit product of different livestock and different ages. This shows that poultry and, to a lesser extent, pork and meat from younger animals are less greenhouse intensive and will therefore incur lower cost increases if carbon trading is applied to livestock production. These meats are likely to become more cost competitive.

TABLE 7: A COMPARISON OF THE GREENHOUSE INTENSITY OF MEATS FROM DIFFERENT TYPES AND AGES OF LIVESTOCK

Animal	**Kill age** *(years)*	**Emissions** *(kg CO_2-e per year)*	**Dressed weight** *(kg/hd)*	**Greenhouse Intensity**		
				kg CO_2-e per kg dressed wt	*As a % of beef*	*As a % of poultry*
Beef	3	1616	300	16.2	100%	4360%
Steers	1.5	1616	200	12.1	75%	3270%
Calves	0.3	1616	50	10.8	67%	2900%
Lamb	0.5	149	15	5.0	31%	1340%
Sheep	2	149	20	14.9	92%	4020%
Sheep	3	149	20	22.4	138%	6030%
Pigs	0.25	419	50	2.1	13%	560%
Poultry	0.12	4.5	1.4	0.4	2%	100%

The impacts of carbon trading on the costs of processing non-meat products will also affect demand for these products.

6.3.4 Overall impacts on red meat production

The consequence of all these changes could be a significant contraction of the red meat production industry.

The Australian Bureau of Agricultural and Resource Economics (ABARE) has run a large scale model that forecasts the economic impacts of implementing the Kyoto Protocol[18]. The model predicts the impact of cost increases on meat and milk production in Annex B countries due to greenhouse policies that include an international carbon trading system. Australian meat and milk production is predicted to fall by 2.4%, more than New Zealand (-1.9%), the United States (-1.7%), the European Union (+0.1%) or the former Soviet Union (+4.5%). The principal reason for the relatively large decline in Australia is the relatively high emission intensity of its livestock production. Importantly, the decreases in production are predicted to be considerably higher if no international carbon trading system is established, since Australia would have to meet its Kyoto target without the option of purchasing credits from cheaper emission abatement options overseas.

[18] Brown S, Kennedy D, Polidano C, Woffenden K, Jakeman G, Graham B, Jotzo F and Fisher BS (1999) *Economic Impacts of the Kyoto Protocol: Accounting for the Three Major Greenhouse Gases*. Australian Bureau of Agricultural and Resource Economics (ABARE), Canberra.

According to the ABARE modelling, production is predicted to decline in most areas because the imposition of a 'cost' for greenhouse gas emissions will:

- increase the cost of livestock in Annex B countries so that some production switches to non-signatory developing countries unaffected by the Kyoto Protocol; and
- change consumption patterns so that less meat is consumed.

Note that the contraction predicted by ABARE covers all meat and dairy products. Red meat is more exposed than much of the rest of this sector and could therefore expect more severe impacts.

Australia is most affected because the greenhouse emission intensity of our livestock production is high relative to other Annex B countries, presumably because of poorer feed quality and conversion in many areas due to Australia's greater reliance on grazing unimproved pasture rather than feedlotting.

Clearly, the cattle and sheep meat industries are potentially highly vulnerable to policy measures to reduce greenhouse emissions. Under current livestock emission scenarios, implementation of some of the measures now under discussion could seriously disrupt the meat industry and its communities in many areas of rural Australia.

However, as discussed in Section 6.2.7, political and social considerations will deter government from actions that cause economic and social damage in rural Australia. Moreover, the industry has many opportunities to respond to the greenhouse challenge by reducing its emissions. These opportunities form the theme of the next chapter.

KEY POINTS – HOW WILL GREENHOUSE POLICY AFFECT THE INDUSTRY AS A WHOLE?

Greenhouse policy could lead to:

- *a reduction in livestock production;*
- *an increase in the costs of producing complementary products such as wool, possibly resulting in reductions in herd numbers and further increasing livestock prices due to contracting supply;*
- *a shift towards intensive production such as feedlots from less intensive and less efficient broad-acre operations (unless these are able to compensate for their emissions by producing carbon sinks);*
- *a competitive disadvantage to Australian meat exporters in comparison to the large South American producers;*
- *a shift from greenhouse intensive red meats to pork, chicken and non-meat alternatives; and*
- *an overall contraction of the red meat production industry.*

7 RESPONDING TO THE CHALLENGE

It has been shown that greenhouse policy could severely affect the red meat production industry. Options are available for processors, livestock producers and the industry collectively to meet this challenge. Meat processors and their allies in the livestock production sector could develop and adopt measures to reduce emissions per unit product, thereby reducing risks and liabilities. The broader industry could encourage emission reduction and, in liaison with related industries, develop and promote policy positions that encourage the best possible policy outcome for its members.

Such options are considered in this chapter, starting with a reminder that industry efforts must occur in an environment characterised by uncertainty.

Note that government assistance, including project funding, may be available to assist individual operators and the industry generally to improve its greenhouse performance[19].

7.1 PLANNING IN AN UNCERTAIN ENVIRONMENT

Industry greenhouse planning needs to occur in an uncertain environment, because much is still unclear about greenhouse policy and how it may affect the sector. Critical areas of uncertainty discussed in previous sections that will shape the impact of greenhouse policy measures on meat processors include:

- whether the Kyoto Protocol comes into force;
- the operational details of the Protocol, particularly in relation to carbon sinks;
- whether carbon trading is established in Australia;
- the nature of any carbon trading system and the extent to which it is applied to agricultural emissions and carbon sinks;
- the extent of take-up of carbon trading internationally;
- the nature of other Australian greenhouse policy measures; and
- the ways in which carbon trading and other greenhouse policy measures impact on other sectors of the national and international economies.

Some other factors that could be important are:

- *The effect of climate change on Australian livestock production* – shifts in the intensity of rainfall and drought events may reduce the viability of livestock production in some areas and improve it in others. Changes in grain and other stockfeed availability and price are also likely.
- *Deregulation and national competition within the power industry* - this may reduce power prices, softening the impact of increases due to greenhouse policy.
- *'Green' consumerism and investment* - there is a growing trend for consumers, businesses and investors to favour products and companies able to that demonstrate high standards of environmental protection. Leading international businesses, including major retail chains, are moving towards specifying that suppliers have environmental accreditation. This may in time extend to greenhouse emissions management, and could further pressure industry to adopt best practices.
- *Effects on other products and activities* - other products from livestock (milk, wool, and hides) may share some of the additional costs arising from carbon trading.

[19] See the AGO website at www.greenhouse.gov.au for further details.

Perhaps the most important of all uncertainties is the extent to which the meat production industry is able to reduce its greenhouse emissions. A range of management practices and technologies could help in this regard, and are discussed below.

7.2 RESPONSE OPTIONS FOR RED MEAT PROCESSORS

7.2.1 Best Practice Management

To reduce the impact of operating in a carbon constrained economy, processors need to decrease their emissions per unit or product, or more importantly per dollar value of product. Best practice management and practice involves identifying and implementing environmentally and economically sustainable measures to reduce emissions, particularly in the areas of energy efficiency and waste management.

Best practice management of greenhouse impacts corresponds well with best practice generally, and can lead to advantages such as:

- reduced management and other costs;
- greater efficiency;
- reduced risks;
- reduced wastage;
- better client service;
- better public relations;
- easier compliance with government requirements; and
- a safer workplace.

As such, identifying ways to reduce greenhouse impacts can be seen as an opportunity to improve business performance.

Elements of best practice are considered below. Best practice livestock management is considered in Section 7.3.

7.2.2 Improve process energy efficiencies

Some options for improving process energy efficiency and reduce greenhouse gas emissions from processing are given in Box 9.

The benefits of energy efficiencies can be marked. One Australian abattoir recently invested in heat exchange equipment that cost less than $10,000 to install but saves around

Box 9: Ten practical ideas for reducing greenhouse gas emissions from meat processing energy

1. *Conserve energy (e.g. make sure process water is not heated beyond the minimum temperature acceptable for each operation).*
2. *Use cleaner sources of energy such as renewable energy and natural gas instead of coal, oil or electricity.*
3. *Reduce heat losses from boilers through better design and insulation.*
4. *Reduce chilling and refrigeration energy through:*
   - *more efficient equipment (e.g. better insulation and pumps);*
   - *more efficient practices (e.g. 'hot' boning and packing at integrated facilities rather than 'kill and chill' operations); and*
   - *staff training (e.g. reduce loss of cold air from storage areas by minimising the time doors are open).*
5. *Reduce gas use by installing biofilters rather than afterburners.*
6. *Reduce the volume of heated wastewater generated.*
7. *Install heat exchangers to preheat fresh process water using hot wastewater.*
8. *Concentrate organic wastes from solids and wastewater to improve the viability of energy recovery from biogas collected from anaerobic ponds (see Box 11).*
9. *Reduce wastewater aeration requirements by minimising wastewater volumes and organic loads through water conservation and recovery of fats and blood.*
10. *Reduce energy use by wastewater treatment aerators through better systems, e.g. dissolved oxygen detection systems to switch aeration equipment on and off.*

$20,000 worth of energy per month.

There appears to be scope for most meat processors to achieve cost savings through improved energy efficiency that would more than cancel out the likely cost increases due to carbon trading.

7.2.3 Improve transport energy efficiencies

Options for improving transport efficiencies include converting vehicles to gas and reducing transport distances, for example through increasing reliance on local feedlots.[20]

7.2.4 Reduce emissions from organic waste

Greenhouse emissions from waste mainly comprise:

- CH_4 from anaerobic management of organics in wastewater or solid waste; and
- N_2O from poor management of sludges and manure.

These emissions can be reduced by:

- reducing the total organic waste load through more efficient processing (e.g. greater fats and blood recovery);
- biogas recovery and flaring;
- energy recovery (see Box 10);
- managing waste aerobically through aeration and/or composting (see Box 11); and/or
- managing wastewater and applications of manure and sludge to land so that excess nitrogen application is avoided, in order to minimise denitrification leading to emission of N_2O.

Box 10: Energy recovery from organic waste

Some larger meat processors may be able to profitably recover energy from waste, especially due to incentives and changed cost structures resulting from carbon trading and other current and expected greenhouse policy measures. Wastewater, sludges and solid wastes with high organic load can be anaerobically treated to generate CH_4 that can be captured and burnt as a source of fuel. Where very large quantities of biogas are produced, electricity generation may be viable.

The viability of energy recovery can be improved by:

- *concentrating organic waste streams, for example through water conservation;*
- *use of biogas in 'dual fuel' boilers that also use natural gas;*
- *supplementing waste streams with organics from other sources such as feedlots, food processors or water authorities; and*
- *sharing a high-yield 'biodigestor' with a local water authority or other businesses that produce large organic waste streams.*

Under the National Policy on Renewable Energy, electricity retailers are required to source 2% of their electricity from renewable sources by 2010. 'Biofuels' – such as gas produced from anaerobic decomposition of waste – are eligible renewable sources. Generators of renewable power will be issued with a certificate for each kWh of electricity generated, even if used on-site. Retailers will be required to purchase enough certificates from generators to demonstrate they have reached their target. The likely value of each certificate is 1 to 2.5 cents per kWh on top of the price of energy.

The policy will improve the viability of recovering energy from meat processing waste will be improved, since processors will be able to obtain and sell renewable power certificates. For further information, see www.greenhouse.gov.au/markets/2percent_ren

[20] For further information, see Bureau of Transport and Communications Economics (1996) *Transport and Greenhouse: Costs and Options for Reducing Emissions*. *BTCE report 94*. Canberra.

Box 11: Composting manures and solid wastes

Manures, paunch and sludge waste can be composted. Domestic garden and amenity markets for compost are well established, and horticultural markets appear to be growing. Prices for composts are typically similar or even below production costs, but savings are made on waste disposal costs. These – particularly the cost of landfilling organics – are likely to rise due to carbon trading and greenhouse policy. For example, the application of carbon trading to landfill emissions at a permit cost of at $30 per tonne CO_2-e could increase tip fees for organics by as much as $60 per tonne. Such prices would make composting viable even if compost was given away!

Use of composts as a substitute for synthetic fertilisers will reduce greenhouse emissions from fossil fuels used in fertiliser production and can increased stored soil carbon levels.

Case study in best practice management – Composting manures

A NSW meat processing works is composting manure from its feedlot operations for sale to local farmers and vine yards. The composting operation uses woody waste from nearly sawmills and stable straw as bulking agents, which means that potential CH_4 emissions from landfilling these organic wastes are also avoided.

7.2.5 Increase the value of products

To improve competitiveness in a carbon constrained economy, meat processors should aim to reduce the greenhouse intensity per unit value of product. One way of achieving this is to reduce emissions – another is to add value to products.

Options include:
- improving product quality;
- developing and expanding production of lines of high value meat products for specific markets; and
- marketing products as greenhouse / environmentally 'responsible' products and contributing to Australia's market advantage in 'clean and green' agricultural products.

Processors could also investigate the viability of exploiting wasted by-products from meat processing that can add value per kg HSCW, such as:
- recovery of fats, blood protein, oils and other nutrients from wastewater for reuse (see Box 12); and
- composting or recovering biogas energy from organic waste.

Box 12: Case study in best practice management – Maximising product by minimising waste

Recovery of fats, blood protein, oils and nutrients from process wastewaters increases product per animal processed. It also reduces organic and nitrogen loads, limiting water treatment costs and the potential for the wastewater to generate CH_4 and N_2O.

A NSW processor, in addition to maximising fat and blood capture rates through rendering operations, is developing a system for concentrating stick water through evaporation to produce a paste that can be sold to pet food manufacturers as a feed additive. This will reduce wastewater treatment costs and produce a valuable by-product.

7.2.6 Consider greenhouse issues in investment decisions

Current investment decisions need to consider how the increasing prominence of the climate change may affect proposed activities. Meat processors should factor greenhouse issues into the planning and design of proposed expansions

or new facilities, paying particular attention to energy use and efficiency and the potential for biogas energy recovery.

7.2.7 Consider diversifying

Given the likely trend towards meats that are less greenhouse intensive than beef and sheep, meat processors may wish to consider options for diversifying their operations.

One option would be to source and process meats such as pig meat and poultry, though this would require establishment of new plant.

Kangaroo meat is a less greenhouse intensive, but would require a marketed change in consumer demand before it could substitute for conventional red-meat products. It cannot be considered a realistic alternative, particularly for export markets where there are restrictions on the import of kangaroo products and likely consumer resistance.

7.2.8 Encourage reduced emissions from livestock

Because greenhouse policy is likely to affect meat processors most severely due to price impacts on supplies, processors should encourage livestock producers to implement practices that reduce their greenhouse emissions and should consider establishing supplies having lower emission intensities. Processors owning feedlots should adopt best practice measures in their operations. Methods for reducing the greenhouse intensity of livestock raising are considered in the next section.

KEY POINTS – RESPONSE OPTIONS FOR MEAT PROCESSORS

Best practice greenhouse management is consistent with good abattoir management. Best practice measures for meat processors include:

- *improving process energy efficiencies, particularly of electricity;*
- *improving transport efficiency;*
- *reducing anaerobic management of waste, or capturing biogas emissions for flaring or preferably energy recovery;*
- *managing nitrogen rich wastewater and manure so that it does not promote denitrification and subsequent production of the highly potent greenhouse gas N_2O; and*
- *reducing emissions from abattoir feedlots.*

Processors could also reduce their greenhouse liability by:

- *increasing the value of products;*
- *considering greenhouse issues in investment decisions;*
- *considering diversification to non-ruminant meats; and*
- *encouraging suppliers to reduce greenhouse gas emissions.*

7.3 RESPONSE OPTIONS FOR LIVESTOCK MANAGEMENT

It has been shown that the most significant greenhouse issue for meat processors is the 'upstream' emissions from livestock, and that feedlots attached to larger abattoirs can be the largest source of greenhouse gas emissions from those premises. Application of carbon trading or alternative policy measures to livestock could significantly increase meat prices.

Livestock managers may be able to reduce their greenhouse liability through one or more of four generic approaches, involving emission reductions:

- per head – for example through vaccines, feed additives or improved food conversion rates;
- per kilo – for example through practices that reduce the time needed to prepare animals for market, such as improved feed conversion or feedlotting;
- per hectare – for example through increasing the size of carbon sinks on grazing properties by means of tree planting, reducing stocking rates and curtailing biomass burning; and
- per dollar – for example through better finishing.

The most promising option is to reduce CH_4 emissions by intervention in rumen digestive processes. This and other options are discussed below in more detail. Most are consistent with good industry practice and current trends.

7.3.1 Reduce enteric methane production

Scientists in Australia and around the world are working to develop techniques for reducing the rate of enteric CH_4 produced by ruminant digestion[21].

CH_4 is a non-critical by-product of digestion, and it is possible to change the digestion processes in the rumen to reduce the amount of CH_4 generated through chemical and biological techniques that:

- inhibit or divert hydrogen production; and/or
- reduce the activity of methanogens – bacteria and protozoa that produce CH_4 by metabolism of hydrogen.

Take-up of hydrogen by carbon represents a loss of energy, so in addition to the greenhouse benefits, these techniques can increase feed conversion efficiencies and lead to higher rates of live weight gain.

The principle means proposed for reducing enteric CH_4 are food supplements and vaccines, some known today and some under development. Feed additives under development will require a daily dietary ration, making them more suited to intensive livestock production, although there is some prospect of fodder treatment (spraying of pasture) or the placement of anti-methanogenic lick blocks in broad-acre situations. Under research conditions, high maintenance feed additives have recorded reductions in CH_4 production of up to 50%. The possibility of completely eliminating CH_4 production has been raised. CSIRO and international research into these techniques continue.

However, it seems unlikely that a 'techno-fix' panacea will allow 'business as usual' in the livestock sector. Firstly, the field efficacy of the various treatments remains unproven – they may turn out to be less effective than expected.

[21] Detailed information about Australian research and initiatives is given in the proceedings of a Bureau of Resource Science (BRS) workshop titled *Meeting the Kyoto Target: Implications for the Australian Livestock Industries*, Canberra, 4-5 November 1998 – obtainable from www.brs.gov.au/publications/greenhouse.html. Information about the US government's 'Ruminant Livestock Efficiency Program', which aims to reduce CH_4 from livestock is given at www.epa.gov/rlep.

Some disquiet has been expressed about the progress of Australia's research effort and the extent of reliance on CSIRO. Secondly, the cost of the treatments is unclear – they may turn out to be prohibitive in many circumstances. Thirdly, treatments may be unsuitable for many circumstances. In particular, CH_4 reduction is less practicable and less effective in low intensity grazing systems. This equates to a strong competitive advantage for high intensity systems and a corresponding disadvantage to broad-acre livestock raising.

The industry would be ill-advised to rely completely on the greenhouse emission abatement promise of feed additives and vaccines.

7.3.2 Improve production efficiency

Greenhouse gas emission reductions per kilo of meat are achieved by any practice which improves the efficiency of food conversion or which enables animals to reach market weight and be slaughtered at a younger age. Such practices include:

- higher quality feed;
- good health management; and
- selection of animals with higher genetic disposition for growth.

The objectives of increasing live weight gains and reducing the age at slaughter are consistent with industry best practice and trends. Again, this tends to promote intensive practices such as feedlotting at the expense of rangeland grazing.

Production efficiencies alone are unlikely to reduce emissions sufficient to maintain the viability of meat production at current levels.

7.3.3 Reduce stocking rates and enhance carbon sinks

Reducing stock numbers and access on broad-acre landholdings will produce a twin greenhouse benefit of reducing CH_4 emissions per hectare and increasing carbon sinks in soil, woody vegetation, pasture cover and root material. Depending on the outcome of the Kyoto implementation negotiations (see Section 5.3.2), broad-acre landholders may be able to obtain financial benefits from enhancing carbon sinks.

Box 13: Case study in best practice management – Berrybank Farm

Berrybank Farm in the Windermere district of Victoria runs a 1600 sow piggery that produces a daily average of 250,000L of slurry with an organic solids content of 1.7%. Using a high efficiency dissolved air flotation plant and a two stage anaerobic digestion system, the farm produces over $100,000 in electricity per year, as well as water, fertiliser and stabilised garden product. Payback on the capital investment was achieved in about six years.

Greenhouse policy measures will improve the viability of such systems.

7.3.4 Reduce emissions from waste

The anaerobic breakdown of manure gives rise to CH_4 emissions. Feedlot waste can be managed so that these emissions are captured and oxidised or used for energy recovery[22].

Energy from this source can

[22] Information about the US government's 'AgStar Program', which aims to encourage biogas collection from confined animal feeding operations, is given at www.epa.gov/agstar.

be used on-farm or sold to the grid, and are likely to become increasingly viable due to carbon trading and the National Policy on Renewable Energy (see Box 13).

7.3.5 Increase the value of products

As with processing, an increase in the value of product will help reduce emissions per dollar of revenue. Opportunities for increasing the value of meat products include:

- improving meat quality through herd improvement and feed management;
- targeting high value niche markets; and
- promoting products as 'Clean and Green'.

Improving the value of non-meat products such as leather will also reduce greenhouse intensity per unit of income, possibly allowing reduced stocking rates without a fall in production.

KEY POINTS – RESPONSE OPTIONS FOR LIVESTOCK MANAGEMENT

- *Management measures are available to reduce CH_4 emissions from livestock per head, per kilo, per dollar and/or per hectare.*
- *The most promising approach is to reduce enteric CH_4 emissions through feed additives and vaccines that change rumen digestive processes. Australian and international research in this regard continues.*
- *However, it seems unlikely that a 'techno-fix' panacea will allow 'business as usual' in the livestock sector. The industry would be ill-advised to rely completely on the greenhouse emission abatement promise of feed additives and vaccines.*
- *Other measures to reduce livestock emissions include improving production efficiency, reducing stocking rates, enhancing carbon sinks, reducing emissions from feedlot wastes and increasing the value of products.*

7.4 RESPONSE OPTIONS FOR THE MEAT PROCESSING INDUSTRY COLLECTIVELY

Industry organisations such as MLA and AMPC have a key role in promoting awareness of greenhouse issues and cost-effective best practice management practices to meat processors and, in the interests of their membership, livestock producers. The following strategic objectives are suggested to fulfill this role.

7.4.1 Facilitate improved processing performance

In addition to the benefits to operators discussed in the previous section, adoption of best practice greenhouse management benefits the meat industry as a whole by demonstrating to government and the community that it is 'doing its bit' as a responsible corporate citizen in addressing the greenhouse issue. Taking voluntary action will gives the industry's views more weight in the complex negotiations leading up to carbon trading.

Actions that can be taken by industry as a whole, through MLA and AMPC include:

- Helping operators through information, contacts and best practice guidelines etc.
- Benchmarking practices so operators know how they compare with others in Australia and overseas.
- Assessing and publicising measures to improve greenhouse performance.
- Encouraging operators to join the Federal Government's *Greenhouse Challenge*. To date seven food sector companies have joined the program, but none of these are from the meat processing sector. Note that it is possible for industry groupings, such as AMPC, to join the program. Under a carbon trading system, credits for early emission reductions would only be available to members of the program.

7.4.2 Support and educate livestock producers and allied industries

Livestock production is the link in the meat production chain most at risk from greenhouse policy responses. Alliances need to be developed with organisations such as the Cattle Council of Australia, and policy positions need to be established to support livestock producers in responding to the greenhouse issue. For example, meat processors could support:

- research funding for anti-methanogens and other means of reducing livestock emissions;
- exclusion of agriculture from carbon trading, or a carbon trading system design that protects the interests of livestock producers (see Box 14);
- development of land management accreditation systems that allow governments to verify reduced livestock emission levels at least cost to land managers; and
- government assistance for the sector in achieving these measures.

Box 14: Designing a carbon trading system to suit producers and processors

It was shown in Chapter 6 that the main likely impact of carbon trading on meat processors would be unrelated to their own emissions, but would be rather due to increases in livestock costs.

Ideally, carbon trading would exclude livestock producers or allow agriculture to develop its own separate trading system that protects it from wealthy and less emission-intensive industries.

However, if agriculture were to be included, meat processors should support a system design that best protects the interests of livestock producers. Characteristics of a suitable system would be:

- *exclusion of farmers with small number of head;*
- *'grandfathering' of the initial permit allocation;*
- *wide definition of carbon sink activities;*
- *international application of carbon trading to a wide range of industries;*
- *use of land management accreditation systems as a basis for determining emissions and allocating permit requirements; and*
- *allows Australia to export technologies for reducing emissions from livestock production to developing nations as part of the Clean Development Mechanism.*

There is also a role for individual meat processors, the industry as a whole and government to educate livestock producers about best practices to reduce greenhouse emissions and improve productivity. The industry could support the development and delivery of education programs and cost-effective accreditation programs to help producers to demonstrate that they are achieving greenhouse emissions reductions. It could also consider developing specifications that require greenhouse management measures from suppliers, and investigate the potential markets for 'greenhouse responsible' meats.

The sector could also encourage allied industries such as dairy, wool and hide producers to control emissions. This could help to reduce the impact of greenhouse policy on these industries and limit consequent flow-on effects on the supply of livestock to meat processors.

7.4.3 Build advocacy capacity

The meat processing sector needs to build its capacity to respond effectively to greenhouse policy issues. Alliances need to be built with linked organisations such as the National Farmers Federation. The knowledge base needs be broadened and maintained through a watching brief, probably best managed through MLA. The knowledge base and network of alliances needs to be used to build policy positions for presentation to government.

7.4.4 Seek government support

The Federal Government has given high priority to greenhouse gas emission reduction and has established a range of programs to provide technical and funding support to industry, mainly through the AGO. The industry should seek opportunities to exploit this funding to assist its members reduce emissions and prepare for the carbon constrained economy.

7.4.5 Ensure representation

The sector needs to be active in expressing its policy positions to make sure government pays sufficient attention to possible impacts of some policy measures. In particular, the interests of agriculture based industries in relation to greenhouse policy are very different from those of the energy sector, which has a sustained and well-developed lobbying position (see Box 15).

Box 15: Respondents to the AGO discussion papers on carbon trading

Respondents to these crucial documents are listed on the AGO website. Notably, of the 88 different respondents, only one has a strong livestock-related focus (the National Farmers Federation). The concern of the few rural-based respondents was apparently restricted to carbon sinks.*

Almost a third of respondents were related to the energy industry, and large energy users are also strongly represented. Most of the remainder were in the government, finance, consulting or academic areas.

** see Section 5.2.2*

The meat processing industry may be able to play an important role in demonstrating to government that in a choice between policies leading to costlier energy and policies affecting other areas of the economy, there are some industries, at least, which support higher energy prices.

KEY POINTS – RESPONSE OPTIONS FOR THE MEAT INDUSTRY COLLECTIVELY

- *Industry organisations have a key role in promoting* awareness *of greenhouse issues and cost-effective best practice management practices to meat processors and livestock producers.*
- *Strategic objectives include facilitating improved processing performance, building advocacy capacity, supporting and educating livestock producers and allied industries, seeking government assistance and ensuring representation.*

APPENDIX – SOME USEFUL WEBSITES

Title	Address	Description
Australian Greenhouse Office	www.greenhouse.gov.au.	The site of Australia's key greenhouse management office contains information on emission reduction, government programs and funding opportunities.
Climate Change Newsletter	www.brs.gov.au:80/publications/ccn/index.html	The newsletter is produced quarterly by the Bureau of Resource Science, focusing on the relationship between greenhouse and agriculture, forests and fisheries. This website gives access to all the newsletters.
US Ruminant Livestock Efficiency Program	www.epa.gov/rlep	A joint initiative of the US Environmental Protection Agency and Department of Agriculture, the program's mission is to help producers voluntarily reduce emissions of methane and other greenhouse gases from ruminant livestock production. The site contains information and advice on emissions and their management, including operations overseas,
US AgStar Program	www.epa.gov/agstar	This voluntary effort jointly sponsored by the US EPA, Dept. of Agriculture and Dept. of Energy encourages the use of biogas recovery technologies at confined animal feeding operations to reduce methane emissions.
Intergovernmental Panel on Climate Change	www.ipcc.ch	The IPCC was set up by the UN as the peak body to assess the information relevant for understanding the risk of human-induced climate change. Its website provides detailed technical information on the enhanced greenhouse effect and policy responses.
Pew Center on Global Climate Change	http://www.pewclimate.org/index.html	The Pew Centre is a non-profit, independent organisation founded in 1998 and dedicated to "providing credible information, straight answers and innovative solutions in effort to address global climate change". Its website contains a range of useful 'entry level' information. The centre also runs the Business Environmental Leadership Council which includes 21 major companies interested in supporting the centre's efforts and working on the climate change challenge.
Global Climate Coalition	www.globalclimate.org/index.html	The Coalition provides a strongly greenhouse-sceptical "voice for business in the global warming debate" focusing on the costs of reducing emissions and the uncertainty of greenhouse science. Its website contains reports and commentary on a range of greenhouse issues. The group has suffered some major defections in recent years, including Du Pont, Shell, BP and Ford.
Institute for Global Communications – atmosphere and climate section.	http://www.igc.org/igc/issues/ac/or.html	Links to a range of websites providing information on climate policy and research.