MetaEconomics

Carbon price impacts on red meat producers and processors

Industry-wide and facility-level analysis of the proposed Carbon Pricing Mechanism (CPM)

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metá — (prefix): *sense of change of position or condition, behind or after, beyond, of a higher order …*

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Cover photo: Beef cattle, Southern NSW (2011)

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Abbreviations and glossary

Term	Expansion
$m	million dollars
$b	billion dollars
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
AFI	Australian Farm Institute
AMPC	Australian Meat Processor Corporation
CGE	Computable General Equilibrium (modeling)
CO_2e	Carbon dioxide equivalent (the global warming potential of different greenhouse gases are expressed relative to the warming impact of carbon dioxide. That is, their CO_2 equivalent)
CPM	Carbon Pricing Mechanism
CPRS	Carbon Pollution Reduction Scheme
EITE	Emission Intensive, Trade Exposed (activities)
GDP	Gross Domestic Product
GNI	Gross National Income
GOS	Gross Operating Surplus (a measure of the financial return to business operators. It comprises profit, interest payments and subsidies/ allowances)
GTEM	Global Trade and Investment Model
HSCW	Hot Standard Carcass Weight (a standardised measure for 'dressed' output in the meat processing industry. The AUS-MEAT standard specifies it as a skinned carcass with organs and internal fats removed weighed within 2 hours of slaughter
kt	kilotonnes (or thousand tonnes)
MLA	Meat & Livestock Australia
MMRF	Monash Multi- Regional Forecasting (model)
Mt	million tonnes
Sc.1	Scenario 1
Sc.2	Scenario 2
SSD	Statistical sub-division
tCO_2e	tonnes of CO2 equivalent emissions
tHSCW	tonnes, hot standard carcass weight
USD	US dollars (or US$)

Executive summary

Emissions trading and carbon pricing have been under consideration for over a decade in Australia, and undergone a range of transformations in pursuit of a fair and efficient and effective response to the adverse consequences of climate change. Significant national emission reductions are likely to come at a cost. These reductions are Australia's contribution to the global effort to avoid even higher costs from climate change. The Australian red meat sector will be impacted by the proposed Carbon Pricing Mechanism (CPM) that is currently before Parliament, with a range of new cost and competitiveness pressures that are likely to be dispersed on a size, activity and regional basis. While the sector is highly vulnerable to the future impacts of climate change, its export orientation and low margins also make it vulnerable to increases in input costs.

Purpose of this report

This report addresses the likely implications of the CPM on the Australian red meat supply chain. It focuses on grass fed beef producers, cattle feedlot operators, producers of sheep meat and red meat processors. Three levels of analysis are applied:

- CGE modeling — which follows the same approach as government's own modeling of the CPM, but with greater disaggregation of activities in the red meat sector;
- sector and regional analysis of farm businesses — which examines the range of production cost outcomes that might be expected under the CPM; and
- case studies for three red meat processing facilities — these help illustrate the local issues and challenges for facilities under the CPM.

Economy-wide modeling using MMRF-Green

In order to examine economy wide and inter-industry impacts, we apply the MMRF-Green model. This is Australia's leading greenhouse and region-capable, dynamic computable general equilibrium (CGE) economic model. It is also the base model applied by the Australian Treasury to analyse the impacts of the new carbon pricing mechanism (CPM) on the Australian economy.

Two scenarios were tested, against the same background policy 'base case' adopted by Treasury. These were:

- Scenario 1 – the proposed CPM; and
- Scenario 2 — CPM, with extended exemptions for fuel for heavy road transport and on-farm use of aviation fuel

Scenario 2 reflects current consideration of extending the road freight diesel fuel exemption over the long term, and treatment of on-farm aviation fuel (avgas) use on the same basis as on farm use of other liquid fuels.

MMRF-Green modeling highlights the following key flow-on effects from the proposed carbon price:

1. **domestic final demand is suppressed by the emissions policy;**
2. **the prices of non-traded goods and services tend to fall (relative to base case levels where the economy is more buoyant);**
3. **the fall in real prices extends to wages and salaries which by 2020 are about 1.2 per cent lower in real terms than their projected base case value;**
4. **domestic (and international) greenhouse policies lead to a reduction in Australian exports of fossil fuel and relatively emission intensive products and purchase of overseas emission permits;**
5. **these factors lead to softening in the exchange rate — a real decline of about 0.9 per cent by 2020 is expected (relative to the base case forecast for that year).**

A range of macro-economic outcomes for Scenario 1 and Scenario 2 are reported below in Table ES.1. They indicate a contraction in real GDP of around 0.5 per cent in 2020 and 0.7 per cent in 2025 (relative to base case outcomes), under both scenarios.

Importantly, under Scenario 2, an extension of the road freight diesel exemption has little material impact on the key macro indicators examined. But it does impact some industries. Industries that are heavy users of road transport – such as the red meat and livestock industry – benefit most from the extended road diesel freight exemption, and demand for road freight stays strong compared with other modes which bear full carbon costs and have significant scope to pass these on to customers.

MMRF-Green modeling for the red meat producing activities also suggests that exemptions for direct agricultural emissions along with liquid fuel use, tend to shield the red meat industry from many of the carbon related costs borne by other producers in the economy. And declines in the exchange rate help support export performance in the face of residual input cost increases associated with the CPM. While a lower exchange rate means the cost of imported inputs go up, the Australian red meat industry has a relatively low reliance on these. Non-traded inputs such as labour, services and transport are more important to the red meat industry, and more affected by domestic supply and demand conditions.

On balance, the high level CGE modeling suggests — based on industry wide (and therefore 'averaged') input data — that the lower exchange rate will approximately neutralise the adverse cost impact induced by the carbon price, and result in output changes (relative to the base case) in the order of one to two tenths of 1 per cent. Margins are also affected by changes in input costs across activities.

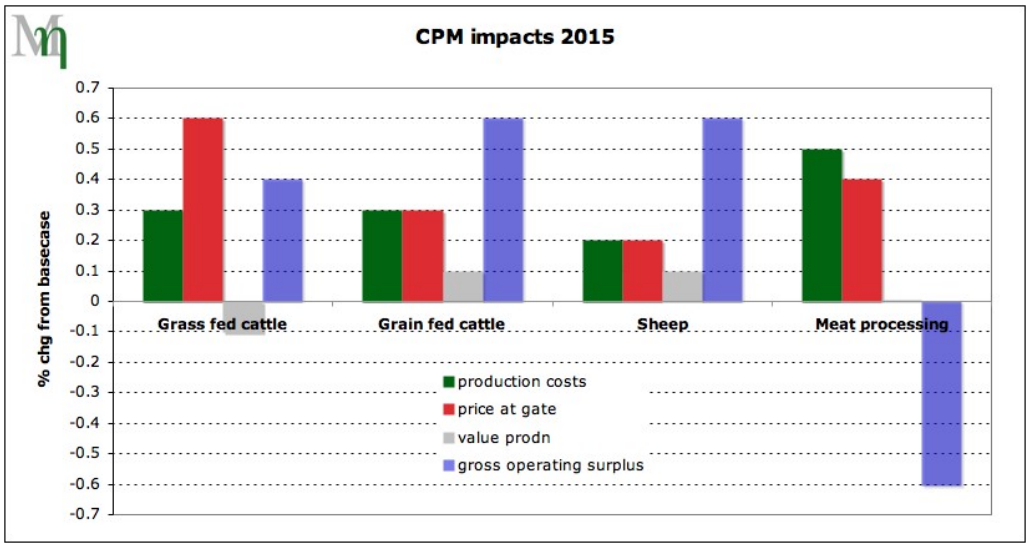
Table ES.1 Macro-economic impacts — deviation from base case

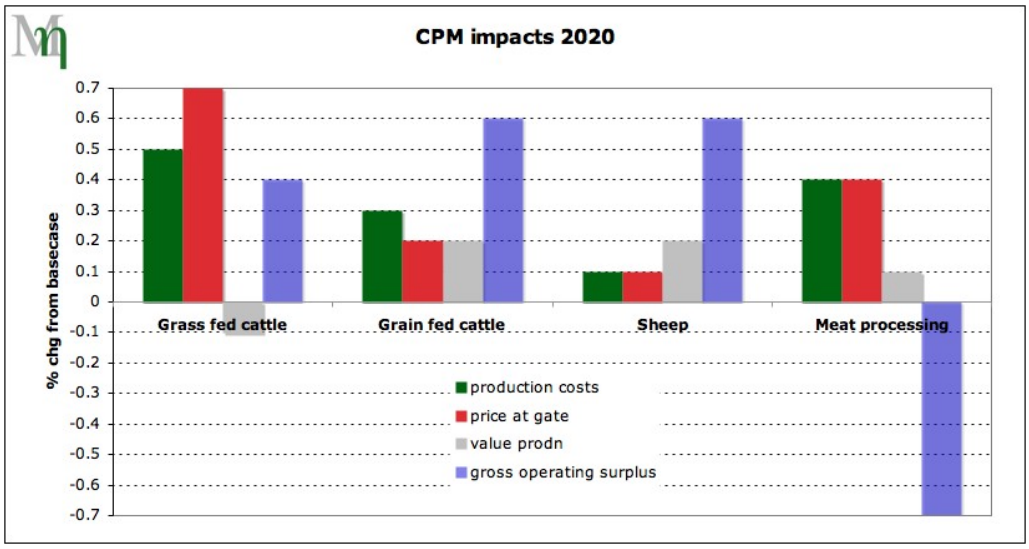
Economic indicator	(Sc. 1) CPM proposal				(Sc.2) Extended road freight rebate & Ag avgas			
	2015	2020	2025	2030	2015	2020	2025	2030
	% deviation from base case							
GDP gwth rel 2010 (Sc–Base)/Base %	17.3	33.9	52.0	72.1	17.3	34.0	52.0	72.1
Real Gross Domestic Product	- 0.4	- 0.5	- 0.7	- 1.1	- 0.4	- 0.5	- 0.7	- 1.1
Real Gross National Product	- 0.4	- 0.6	- 1.0	- 1.7	- 0.4	- 0.6	- 1.1	- 1.7
Real Private Consumption	- 0.4	- 0.7	- 1.2	- 1.9	- 0.4	- 0.7	- 1.2	- 1.9
Employment	- 0.3	- 0.1	- 0.2	- 0.2	- 0.2	- 0.1	- 0.2	- 0.2
Real wage rate	-0.7	-1.2	-1.7	-2.8	-0.7	-1.1	-1.6	-2.7
Exports	+ 0.3	+ 0.2	+ 0.6	+ 0.7	+ 0.3	+ 0.3	+ 0.7	+ 0.8
Imports	- 0.8	- 0.8	- 1.3	- 2.0	- 0.7	- 0.7	- 1.3	- 1.9
Exchange rate	- 0.8	- 0.9	- 1.6	- 2.5	- 0.7	- 0.8	- 1.6	- 2.5
	Aust market prices* — % deviation from base case							
Electricity	19.0	19.6	18.9	26.8	19.0	19.6	19.0	26.8
Coal	117.7	163.8	222.9	283.3	117.6	163.6	223.0	283.3
Natural gas	7.0	6.9	7.6	9.3	7.0	6.9	7.6	9.3
Diesel	18.5	20.6	25.4	30.4	0.3	0.2	19.9	24.9
LPG	8.6	9.6	12.7	16.3	2.9	3.1	12.4	15.9
Other petroleum	2.9	3.1	4.6	6.4	2.8	3.0	4.6	6.4
Chemicals	0.3	0.2	0.7	1.4	0.2	0.1	0.7	1.4
	Greenhouse emissions trading indicators							
Permits bought offshore (Mt CO2e)	22.6	86.6	163.4	217.8	22.8	86.9	163.6	217.9
Value of permit imports (2010 $b)	0.51	2.58	6.50	11.46	0.51	2.59	6.51	11.47

* Price deviations are relative to a CPI numeraire. They represent the degree of price change relative to price changes expected in the basket of CPI consumer goods tracked in the base case.
Source: MMRF Green modeling

Percentage changes in production costs, farm and factory gate prices and the value of output expected from the CPM are shown in Figure ES.2. The CGE modeling suggests that the value (in Australian dollar terms) of cattle, sheep and processed meat output will increase marginally over the next decade under the influence of the CPM — except for grass feed cattle where a marginal reduction in the value of output (linked to a fall in livestock export sales) is expected.

Figure ES.2 Changes in unit costs, prices, operating surplus and output induced by the CPM, 2015 and 2020





However, it is important to note that the CGE assumptions around the uniformity of prices and competitive markets produce distributional impacts that can differ from those observed in the real world. The ability of processors to pass costs backwards along the supply chain to farmers is likely to be under-estimated by the CGE modeling exercise. Previous studies have proposed that around 80 per cent of additional processor costs can be passed backwards to producers in the form of lower prices — though this will depend on regional supply factors.

Dropping down from economy-wide to regional and enterprise level analysis can shed some additional light on how carbon costs are likely to be spread within the red meat industry, and affect producers differently. This analysis indicates that some producers will bear a higher level of costs than the CGE modeling suggests.

Analysis of farm survey data: variation around the mean

To examine differences in production practices and carbon price exposure, a set of specialised regional activities was constructed with profile information from the ABARES Agsurf and MLA Farm Survey databases. Cost profiles were based on reported average farm expenditures over the 5 years from 2004-05 to 2009-10. Results are reported in Tables ES.2 and ES.3.

For cattle production, net cost increases in the range of 0.8 to 1.4 per cent were found from 2015 based on the AgSurf and Farm Survey information, with grain finished beef having the lowest emission cost exposure — after taking exemptions for direct animal emissions and emissions from fuels into account. However, AgSurf's public data set provides no detailed splits between on-farm solid, liquid and gaseous fuel use, and while assuming the dominance of (carbon price exempt) liquid fuel use is likely to be reasonable for most farm operations, **large feedlots and northern beef are notable exceptions**.

Costs for grass fed cattle farmers rise by as much as as 2.3 per cent by 2025 under the predicted carbon price, on the assumption that the input mix does not change substantially over the period. Beef production in WA and Queensland are exposed to similar levels of cost increase — on the stringent assumption that on-farm liquid fuel use will be exempt from the carbon price. In reality, under the CPM proposal as it currently stands, beef producers in northern Australia will be subject to full carbon price increases in their use of aviation fuel and aerial mustering services.

Table ES.2 BEEF cattle producer cost increases due to the CPM — assuming a full carbon price exemption for on-farm fuel use

Year	Beef – Grass (National)	Beef – Grain (National)	Beef - WA	Beef - Qld	Beef - NSW	Beef (200-400 herd)
2015	1.4%	0.8%	1.4%	1.3%	1.3%	1.2%
2020	1.5%	0.9%	1.5%	1.5%	1.4%	1.3%
2025	2.3%	1.6%	2.2%	2.3%	2.1%	2.0%
	Change to average beef farm costs (assuming current production and inputs)					
2015	$3,866	$173,098	$6,037	$5,272	$4,086	$2,425
2020	$4,369	$203,208	$6,608	$5,969	$4,537	$2,709
2025	$6,446	$355,120	$9,621	$8,843	$6,676	$4,073

For feedlot operators the implications of the CPM for annual costs and income can be substantial — adding around $355,120 per year (in 2010 dollars) to the expenses of an average sized feedlot by 2025. Further, there is a concern that the reliance of larger feedlots on LPG (for boiler operations) is under-represented in the industry data, and this will add substantially to the carbon cost exposure. According to the analysis other cattle producers face annual average cost increases ranging from $2,425 to $6,037 per year in 2015, depending on location and speciality. For WA cattle producers, average costs

due to the carbon price rise by almost $10,000 per year by 2025, against a national average cost increase for that year of nearly $6,500 per year.

Similar results are generated in the sheep meat analysis (Table ES.3), although cost exposures are slightly lower for sheep than cattle. **Of the specialised lamb and mutton producers, WA producers appear to have the highest exposures.** Costs to these producers rise by about 1.4 per cent in 2015, and to 2.2 per cent by 2025. Mixed sheep – beef farming has a higher exposure still, with an estimated cost increase of about 1.5 per cent by 2015 under the CPM, rising to 2.3 per cent by 2025.

Cost implications amount to an average increase across the industry of around $2,638 a year by 2015, rising to $4,313 per year (in 2010 dollars) by 2025 — in the absence of action to reduce emission exposures. WA sheep farmers face cost increases of around $12,096 per year by 2025. Victorian sheep-beef producers can expect to face additional costs of about $2,502 per year by 2015, and around $4,258 by 2025 due the new carbon price.

Table ES.3 SHEEP producer cost increases due to the CPM

Input	Sheep (National)	Sheep - WA	Sheep - NSW	Sheep/ beef - Vic	Sheep/ beef - Qld	Sheep (200-500 sale)
2015	1.2%	1.4%	1.2%	1.1%	1.5%	1.2%
2020	1.3%	1.5%	1.4%	1.2%	1.6%	1.3%
2025	1.9%	2.2%	2.0%	1.8%	2.3%	2.0%
	Change to average sheep farm costs (assuming current production and inputs)					
2015	$2,638	$7,673	$4,341	$2,502	$3,551	$2,889
2020	$2,900	$8,306	$4,762	$2,763	$3,910	$3,174
2025	$4,313	$12,096	$6,972	$4,258	$5,519	$4,739

This sub-sector analysis reveals that carbon cost impacts can vary by around 20 per cent from national averages for cattle and sheep for producers. And for feedlots that use LPG for steam treatment of feed the cost increase can be around 3 to 5 per cent – more than double the average for grass fed cattle production. These variations can translate into substantial additional cash costs and impact very heavily on the profit margins of some producers — particularly if additional carbon costs from the meat processing sector are also likely to be passed backwards along the supply chain.

Some evidence of this emerges from the processors, many of which will face substantial new costs under the CPM.

Observations from processor case studies

Case studies of the Oakey, T&R - Murray Bridge and Teys - Rockhampton meat processing facilities were undertaken. The case studies highlight the diversity of arrangements that are in place and being contemplated in order to deal with the increased cost pressures that the CPM will bring. For the three

processors examined, carbon pricing will present a serious challenge to cost structures and future strategies.

Over the next decade, these facilities face additional costs of between $750,000 to $3 million per year as a result of the need to pay for emissions from their waste and energy use. This will put significant pressure on these facilities, and can affect the long term viability of their operations. This can have significant impacts on employment in local communities.

The 25,000 tonne per annum emission threshold can hold the key to a major reduction in emission liabilities for some facilities. Achieving emissions below this threshold will automatically eliminate the need to pay for emissions from wastewater and coal combustion. Nevertheless, even for facilities with emissions below the threshold, the spectre of higher energy costs is inducing a strong focus on opportunities to harness their waste stream for bio-energy production. All case study facilities are looking deeply at covered anaerobic ponds and biogas capture and flaring technologies. However, the economics stack up better for some than others, and the **sector participants are likely to face significant adjustment problems.**

These processors see limited opportunity to pass their costs onto customers given their high export orientation and role as price takers on the world market. This situation faces many in the industry. The need for cost absorption is also likely to be underpinned by the enhanced competitive position of below-threshold operations and the ability of farmers in certain markets to switch supply between processing facilities, or ship their stock interstate or overseas to obtain a higher price.

Key conclusions

The analysis leads to the following broad conclusions regarding the likely (and reported) impacts of the proposed carbon pricing mechanism (CPM) on producers and processes in the red meat industry, and treatment of road freight and on-farm use of aviation fuel:

1. detailed modeling of CPM impacts on the red meat sector suggest less beneficial outcomes than Treasury has reported, and there will be significant residual pressure on some participants and regions;
2. cattle producers and processors have a higher exposure to the carbon price, though regional characteristics can be important — particularly in the North;
3. extending the exemption for fuel used in heavy road transport significantly alleviates residual cost pressures on the supply chain; and
4. extending the exemption for on-farm liquid fuels to Avgas can remove distortions that disadvantage northern beef producers (and other agricultural users of aerial services).

Chapter 1

Carbon pricing ... again

The Australian red meat industry is a major stakeholder in climate change policy — as an emission intensive industry, and as a sector with a major exposure to the costs of climate change itself.

The Australian Government, with input and support from the Australian Greens and a number of Independents, has proposed a new framework for imposing an explicit cost on greenhouse gas emissions reduction within Australia. The new framework has much in common with the previously proposed (and now defunct) Carbon Pollution Reduction Scheme (CPRS), and for that much, at its core, is similar to the model proposed by the Howard Government in their 2006 Emissions Taskforce Report. However, the new Carbon Pricing Mechanism (CPM) differs from the CPRS in some important aspects. These changes can have important implications for the costs and competitive position of producers in the Australian red meat industry, and warrant further analysis.

Where measurement and monitoring costs are cost effective, carbon pricing promises to be an efficient, non-prescriptive mechanism for encouraging lower emission production practices in Australia. And a significant investment in complementary programs and assistance has also been made in an effort to facilitate adjustment and reduce adverse impacts under the scheme.

1.1 Recent carbon pricing developments

Emissions trading and carbon pricing have been under consideration for over decade in Australia, and undergone a range of transformations. Put on the agenda by the Howard government in the late 1990's, the proposal to use a market-based mechanism to support economy-wide commercial incentives to reduce greenhouse gas emissions has generated widespread debate and undergone many transformations – including decisions around the best approach to linking agriculture to the market based emission reduction incentives.

A proposal to develop and introduce a national emissions trading system in the closing stages of the Howard government was embraced by the incoming Rudd Labor government in 2007. Its first official act in Government was to ratify the Kyoto Protocol — the United Nations treaty describing international greenhouse gas emission targets and obligations — at the 13th UN Climate Conference in Bali in December 2007. Work on designing the Carbon Pollution Reduction Scheme (CPRS) began soon after, and involved considerable analysis and intense discussion, negotiation and debate within Parliament and out into the business and broader community over the ensuing 2 years.

Draft legislation detailing the government's proposal for the CPRS, intended to commence on 1 July 2011, was submitted to Parliament in October 2009. It was defeated twice in the Senate, before being put on the backburner by Prime

Minister Rudd on 26 April 2010. During the August 2010 federal election, both the government (now led by Julia Gillard) and federal opposition maintained commitments to reduce national emissions to 5 per cent below 2000 levels by 2020, with the government policy on carbon pricing being to defer the CPRS until at least 2013.

After a close election outcome, neither of the major parties had a mandate to form a government in its own right. The balance of power lay with the Greens and four independents — two from regional NSW, one from Tasmania, one from North Queensland, and a National Party aligned member from Western Australia. With the support of the Greens and three of the independents, a minority Gillard government was sworn in on 14 September 2010. A review of options for the early implementation of a carbon price was part of the policy package negotiated to win cross bench support.

The 'Clean Energy Future' policy package

Under the Gillard government, policy negotiations on Australia's future greenhouse response framework have occurred in consultation with the Multi-Party Climate Change Committee. On 10 July 2011, Prime Minister Gillard released details of a new Carbon Pricing Mechanism (CPM) as part of her government's 'Clean Energy Future' policy package.[1] The CPM's architecture shares many of the features with the Carbon Pollution Reduction Scheme (CPRS) introduced to Parliament by the Rudd government in October 2009. It also differs in some important respects. These differences — and details of coverage that have not yet been fully settled — can have significant implications for red meat producers and processors.

If the relevant legislation passes both houses of Parliament and is signed into law, the CPM will come into effect from 1 July 2012. On 12 October 2011 the Lower House of the Australian Parliament passed a package of 18 pieces of legislation, the primary aim of which is to introduce the Carbon Pricing Mechanism. The legislation is to go before the Senate in November.

The government's new Clean Energy Futures package contains a range of supplementary and support measures than can impact farmers and industry in a variety of ways, as they roll out over the next 5 to 10 years. These span initiatives in the areas of green investment, innovation support, regional adjustment, and environmental management and include the:

- Clean Energy Finance Corporation (with new funding of $10 billion over 5 years);
- Australian Renewable Energy Agency (managing $3.2 billion over 9 years);
- Clean Technology Program (representing $1.2 billion over 7 years, including $150 million earmarked to support the uptake of low emission technology in the food processing sector under the Food and Foundries Investment Program);

[1] See Australian Government (2011), *Securing a Clean Energy Future — the Australian Government's Climate Change Plan*.

- Biodiversity Fund (with a focus on encouraging bio-diverse carbon plantings and funding of $946 million over 6 years);
- deepening of the Carbon Farming Initiative (through formal linking to the CPM, and a $250 million set aside for non-CPM compliant offsets generated under the Initiative);
- Carbon Futures Fund (focused on on-farm abatement technologies and carbon farming, with funding of $429 million over 6 years); and
- Regional structural adjustment assistance (with funding of $200 million over 7 years).

1.2 Purpose of this study

The focus of this study is to build on past research that focused on carbon price implications for the Australian red meat industry, and explore what the new carbon pricing arrangements announced under the Clean Energy Futures package mean for producers and processors. The MLA/AMPC terms of reference highlighted the need for a broad approach that captures the interaction between farming, lotfeeding, transport and processing and the foreign and domestic markets serviced by these activities, and the key impact of carbon costs on their production and profits. Capturing the diversity of production in the sector, and the breadth of potential outcomes under the CPM is also important.

In order to capture these elements, this report employs economy-wide modeling (similar to that used in published government analysis of the CPM) to estimate inter-industry cost and competitiveness impacts, and then applies these to farm and facility based information. Case studies are also used to test and communicate the likely implications of the CPM for the operations of three meat processing facilities, and the regional jobs and income they provide.

Use of the MMRF-Green model of the Australian economy

For this project, we apply the MMRF-Green model to generate empirical results. This is Australia's leading greenhouse and region capable, dynamic computable general equilibrium economic model. The configuration of MMRF-Green is well suited to addressing the industry-specific issues raised in this study. Details of the MMRF-Green model are provided in Box 1.1 below.

Computable general equilibrium (CGE) modeling is a powerful tool for delivering on the study requirements, because it utilises observed industry input-output and trade relationships within the economy. Properly calibrated, a detailed CGE model can provide key insights to the likely cost, income and output changes that will affect participants in the red meat industry as carbon prices influence consumption choices and competitiveness throughout the economy.

However, models are inherently a simplified and aggregated version of reality, and therefore need to be applied and interpreted with this in mind. Case studies and supplementary qualitative analysis focused on markets and production relationships can help add perspective to the CGE results.

Box 1.1 MMRF-Green: a greenhouse and region-capable model of the Australian economy

The Monash Multi-Regional Forecasting (MMRF) model is a multi-regional, dynamic computable general equilibrium (CGE) model. It distinguishes up to eight Australian regions (six States and two Territories) and, depending on the application, up to 144 commodities/industries. The model recognises:

- domestic producers classified by industry and domestic region;
- investors similarly classified;
- up to eight region-specific household sectors;
- an aggregate foreign purchaser of the domestic economy's exports;
- flows of greenhouse gas emissions and energy usage by fuel and user;
- up to eight state and territory governments; and
- Federal government.

The model contains explicit representations of intra-regional, inter-regional and international trade flows based on regional input-output data developed at COPS, and includes detailed data on state and Federal governments' budgets. As each region is modelled as a mini-economy, MMRF is ideally suited to determining the impact of region-specific economic shocks. Second round effects are captured via the model's input-output linkages and account for economy-wide and international constraints. Outputs from the model include projections of:

- GDP and aggregate national employment;
- sectoral output, value-added and employment by region;
- export earnings, import expenditure and the balance of trade;
- greenhouse gas emissions by fuel, fuel user and region of fuel use;
- energy usage by fuel, energy user and region of energy use;
- State and Territory revenues and expenditures;
- regional gross product and employment; and
- regional international export earnings, international import expenditures and international balance of payments.

Chapter 2

Policy analysis: what's new, and important

The Australian red meat and livestock industry has been analysing the implications of an emissions trading scheme for some time. Past studies provide a strong basis for new analysis that focuses on a raft of design changes which stand to have major implications for producers and processors.

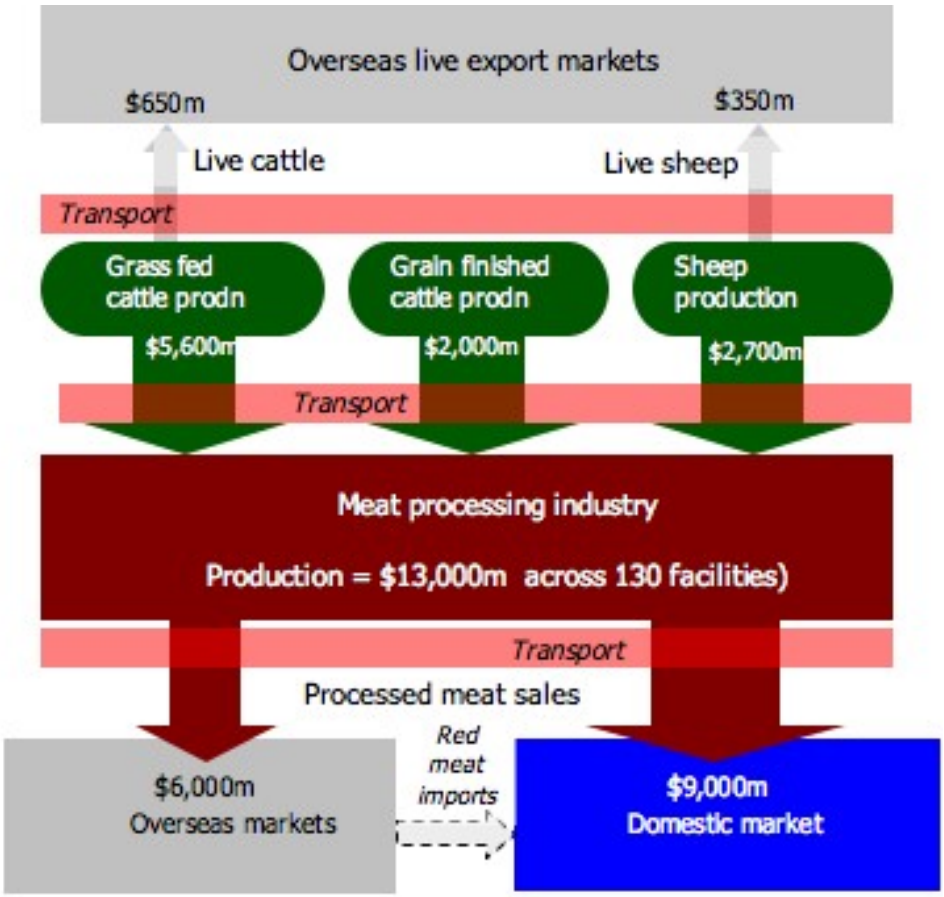
2.1 Issues and analysis for the red meat sector

Taken as a whole, the Australian red meat industry is highly export oriented, with a supply chain comprising thousands of sheep and cattle farms, about 700 feedlots (based mainly in south-east Queensland and the southern States) and around 130 abattoirs where livestock are processed for supply to the meat wholesale and retail trade. And while beef imports to Australia are modest (amounting to around $20 million in 2010), imports of other meat varieties (mainly pork) are more substantial and were valued at around $470 million in 2010.

And for sheep and cattle producers, while there is a degree of live animal trade, the fortunes of these farmers tend to be linked closely to the domestic and global meat markets. For 2010, live cattle exports (mainly of heat tolerant breeds raised in northern Australia) accounted for a little over 12 per cent of grass fed cattle production, while live sheep exports accounted for about 10 per cent of Australian production. These relationships are illustrated in Figure 2.1. Overall, the nature of the supply chain and trade exposures highlights graziers' strong reliance on demand by meat processors, whose economic circumstances are strongly influenced by their competitive position in domestic and overseas markets.

A range of past studies have examined the likely impact of carbon pricing on the cost structures of Australian producers and processors, and its implications for output and margins.

Figure 2.1 Indicative output and export performance for producers and processors in the red meat industry, 2010



Past analysis of carbon price impacts

The red meat and livestock industry has commissioned, and been the focus of, a range of studies seeking to test the implications of a price on greenhouse gas emissions. Key reports referenced in this study include:

- Pricewaterhouse Coopers (July 2008), *Meat and Livestock Australia — Opportunities & impacts of an emissions trading scheme*;
- Pricewaterhouse Coopers (February 2009), *Evaluation of likely cost impacts of the Carbon Pollution Reduction Scheme on 6 red meat processing plants*; (published by MLA);
- Centre for International Economics (June 2009), *Possible impacts of the CPRS on the Australian red meat and livestock industry*;
- Australian Farm Institute (June 2011), *The Impact of a Carbon Price on Australian Farm Businesses: Sheep Production*; and.
- Australian Farm Institute (June 2011), *The Impact of a Carbon Price on Australian Farm Businesses: Beef Production.*
- *Australian Farm Institute (August 2011), Agriculture's excluded, so a carbon price won't add up. Right?, Farm Institute Insights 8(3) August Quarter 2011.*

Together, these provide a strong sense of the potential costs and competitiveness impacts that the red meat sector would be exposed to under a domestic carbon pricing arrangement. Under a broadly based scheme, a wide range of inputs to the agriculture and industrial sector would be impacted by emission constraints and carbon prices. In general, the most highly emission intensive goods and services would be impacted most. And for meat producers and processors themselves, a range of direct greenhouse gas emissions could be subject to the scheme and add to their liabilities and costs.

Modeling the CPRS, with agricultural emissions included

Past studies such as CIE (June 2009) have highlighted the cost implications for the red meat sector if their direct emissions are targeted under a carbon pricing arrangement. CIE (June 2009) noted that if the CPRS imposed a requirement on meat producers to buy and surrender allowances for the greenhouse gas emissions from their livestock, the additional costs associated with that would see a decline in output by 2030 (relative to what it would otherwise be) of about:

- 12 per cent for grass fed beef;
- 7 per cent for grain fed beef; and
- 5 to 6 per cent for sheep meat.

Expected gross operating surplus (GOS, a rough approximation of profit) could decline by about 62 per cent among grass fed beef producers and by around 30 per cent among producers of grain fed beef, mutton and lamb. Many downstream meat processors would be driven to make a loss.[2]

Even with a 90 per cent rebate in place for their direct emission lability, (equivalent to the subsidy arrangement offered to emission intensive, trade exposed (EITE) industries at the time) the CIE analysis indicated an expected fall in grass fed beef production (relative to business as usual) of around 5.9 per cent by 2030, 3.7 per cent for grain fed beef and around 2 per cent for sheep meat. Reductions in gross operating surplus (GOS) of between 15 and 30 per cent were indicated for cattle producers and 11 to 16 per cent for lamb and mutton producers. Again, under this policy scenario, meat processors continue to take a large hit — with estimated falls in profit of between 30 and 75 per cent for 'mid-range' producers, and least profitable producers having their margins wiped out by 2030.[3]

CPRS, with agricultural emissions out

Reliable and low cost measurement of land and livestock emissions has always been a hurdle for policy makers wishing to include agricultural emissions in a

[2] See CIE (2009), Possible impacts of the CPRS on the Australian red meat and livestock industry (June), Scenario 1 analysis, pp. 29-37.
[3] Ibid. Table 3.16.

trading system. More recent analysis by CIE and others has reflected later announcements by those designing the CPRS that plans to extend direct emission liabilities to agriculture would be postponed indefinitely. A range of incentive arrangements have be developed (such as the Carbon Farming Initiative) to encourage reduction of land-based and animal emissions and, in the final design of the CPRS, farmers were excluded from direct emission liabilities arising from animal grazing or cropping, land clearing, soil disturbance or fertiliser use.

However, as indicated in a range of studies, exemption from direct emission liabilities does not mean that farmers are immune from carbon costs. What's more, meat processors are classified as part of manufacturing rather than agriculture and therefore are not automatically entitled to exemptions extended to that sector. Analysis by the Australian Farm Institute (AFI) and PwC (published by Meat & Livestock Australia (MLA)) has highlighted the extent of remaining carbon cost exposures for producers and processors even where emissions from grazing, cropping and other land-based emission activities are omitted from the carbon pricing regime. Key ongoing sources of exposure relate to higher prices for purchased electricity and carbon cost liabilities associated with fossil fuel use for heating, transport, and on site power generation. Meat processors also face additional costs if they are required to account for leakage of synthetic gases from refrigeration systems and methane emissions arising from anaerobic decomposition linked to their wastewater and sullage lagoons.

Past AFI and PwC studies have suggested the following cost impacts for representative producers, based on indicative emission prices comparable to those expected in the early years of the CPRS (See Table 2.1). An assumption of fixed or 'frozen' production and input cost relationships is also an inherent feature of this facility level analysis. Significant impacts are indicated.

An emissions price of about $28.50 would increase costs for the average beef farm in Victoria by around 2.6 per cent (compared to a national average increase for the industry of about 2.2 per cent), and led to an increase of around 3.1 per cent for the average NSW sheep farmer (compared to 2.0 per cent nationally). And a review of the costs of 6 Australian meat processing facilities faced with a $25.00 emissions price, found that additional costs ranging from $9.40 to $34.60 per tonne HSCW were in prospect.[4]

[4] HSCW is a standard output measure in the red meat industry. It stands for Hot Standard Carcass Weight.

Table 2.1 Indicative carbon cost exposures with agricultural emissions excluded from permit liabilities

	CO_2 price	Entity	Cost impact (year 10)
Beef cattle farming			
Aust - beef	$28.47	Avg farm	+ 2.2%
Qld - beef	$28.47	Avg farm	+ 2.1%
Vic - beef	$28.47	Avg farm	+ 2.6%
Sheep farming			
Aust - sheep	$28.47	Avg farm	+ 2.5%
WA - sheep	$28.47	Avg farm	+ 2.5%
NSW - sheep	$28.47	Avg farm	+ 3.1%
Red meat processing			
Plant 1 - direct emissions > 25Kt CO2e pa	$25.00	Actual plant	+ $29.40 per tHSCW or $6.30 per head
Plant 2 - direct emissions > 25Kt CO2e pa	$25.00	Actual plant	+ $27.30 per tHSCW or $7.60 per head
Plant 3 - direct emissions > 25Kt CO2e pa	$25.00	Actual plant	+ $34.60 per tHSCW or $0.80 per head
Plant 4 - direct emissions > 25Kt CO2e pa	$25.00	Actual plant	+ $14.10 per tHSCW or $4.60 per head
Plant 5 - direct emissions > 25Kt CO2e pa	$25.00	Actual plant	+ $12.10 per tHSCW or $4.10 per head
Plant 6 - direct emissions < 25Kt CO2e pa	$25.00	Actual plant	+ $9.40 per tHSCW (per head breakdown not available)

Notes: tHSCW = tonnes Hot Standard Carcass Weight – a common measure of output for the red meat industry.

Source: Australian Farm Institute (Jun. 2011a), The Impact of a Carbon Price on Australian Farm Businesses: Beef Production, Australian Farm Institute (Jun. 2011b), The Impact of a Carbon Price on Australian Farm Businesses: Sheep Production and Meat & Livestock Australia (Feb. 2009), Evaluation of likely cost impacts of the Carbon Pollution Reduction Scheme on 6 red meat processing plants.

These additional costs are of critical concern in an industry where scope to pass on costs is quite limited, and margins can be very low. Where costs rise and these increases cannot be passed on in the form of higher prices, or to do so would result in substantially reduced profit margins, the economic viability of current operations can come under significant pressure.

Emission liability thresholds

A key dimension of carbon pricing analysis also relates to issues around the emission liability threshold. Under the National Greenhouse and Energy Reporting System (NGERS), large energy users and emitters are obliged to report annually on their energy usage and greenhouse gas output. Facilities with emissions output equivalent to 25 kilotonnes of carbon dioxide or more per year, or energy consumption of at least 100 terajoules (ie. over 25,000 megawatts of electricity or 2.5 million litres of fuel) per year are legally required to register and report under NGERS. Facility and corporate group registration requirements for NGERS are illustrated in Figure 2.2 below.

Under the CPRS, greenhouse gas emitters with Scope 1 emissions of 25,000 tonnes or more were also required to assume direct responsibility for their on-site emissions. Scope 1 emissions entail direct emissions from all sources and activities (eg. fuel combustion, waste emissions, industrial process emissions, gas leakage, etc), excluding livestock, cropping and land use emissions.[5] About 1000 Australian emitters were identified as likely to have direct emission liabilities under the proposed scheme, including the largest producers in the meat processing industry. A similar scheme is proposed under the CPM.

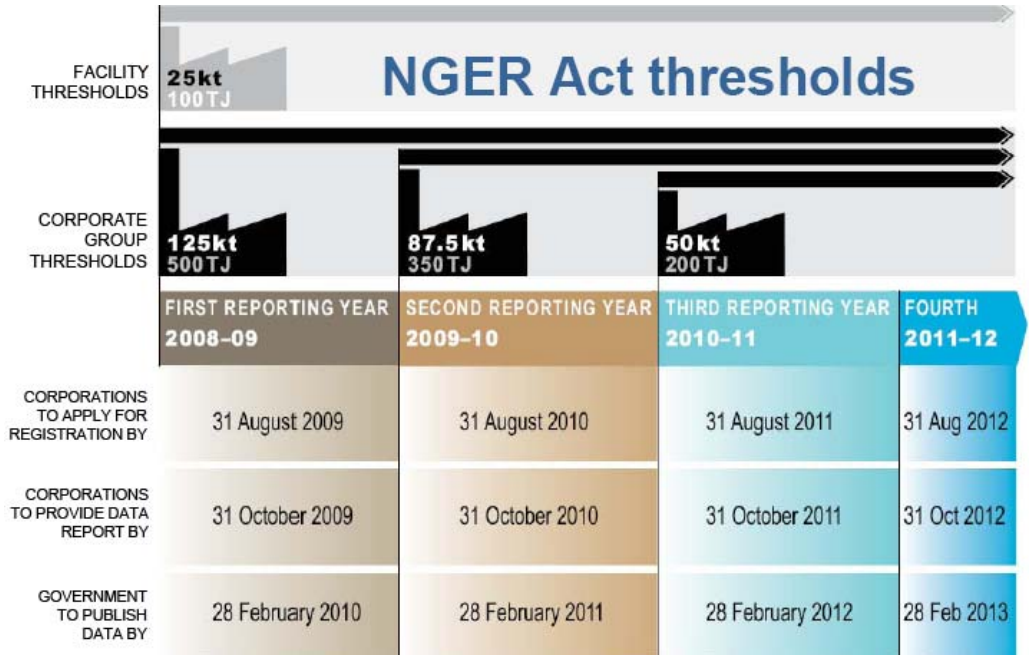
The taxation effect of carbon prices can fall more heavily on producers with direct emissions output exceeding the 25,000 tonnes per annum threshold. A below-threshold producer, using a similar production process and input mix, will escape these direct permit obligations — and where a significant share of emissions are not produced through fossil fuel combustion — this producer will see a reduction in the cost differential (per unit of output) between their operation and that of their larger counterparts (which generate more than 25,000 tonnes of CO_2e per year).

The distinction between direct energy and non-energy emissions becomes important because, under the CPRS arrangement (and most emissions trading system designs), coal, oil and gas suppliers were to take on a default liability for the emissions that are assumed to be generated through combustion of their product, and these costs were then to be loaded into the product price and flow along the supply chain to smaller customers.

For meat processors, whose wastewater methane emissions can add significantly to their Scope 1 emissions profile, the liability threshold can have major implications for costs and profitability.

[5] The hierarchy of emission responsibility and exposure is categorised for assessment purposes into Scope 1, Scope 2 and Scope 3. As noted, Scope 1 covers direct emissions arising on site (or from vehicles and equipment being operated by the corporate entity). Scope 2 refers to emissions generated upstream in the production of electricity and Scope 3 includes emissions associated with the production and delivery of other goods and services such as transport services, metal products, chemicals, etc. And for some landfill operations a Scope 1 emissions threshold of 10,000 tonnes CO_2e pa applies.

Figure 2.2 National Greenhouse and Energy Reporting System (NGERS) registration thresholds



Source: Dept of Climate Change and Energy Efficiency (DCCEE), www.climatechange.gov.au/government/initiatives/national-greenhouse-energy-reporting/business-need-to-report.aspx (accessed 10 August 2011)

Smaller processors could see an improvement in market share as the carbon price raises the costs of their larger competitors.

2.2 Changes in the carbon pricing proposal

While the CPRS and past studies provide useful background for thinking through the likely implications of carbon pricing for the Australian meat industry, the announcement of the new Carbon Pricing Mechanism on 10 July this year has introduced a set of new elements that can affect stakeholders.

Comparing the CPRS and current proposal

Key design elements and carbon price policy changes within the new carbon pricing mechanism (CPM) that are likely to have important implications for red meat producers and processors include:

- exclusion of agricultural emissions from liabilities under the CPM (as in the final design proposal for the CPRS);
- a higher initial regulated emissions price and longer period of price control ($23 in 2012-13, rising by 2.5 per cent per annum in real terms for 2013-14 and 2014-15);
- exemption of light vehicle transport emissions from the carbon price, and an ongoing exemption for liquid fuels used by agricultural producers;

- a carbon price exemption for emissions from heavy road transport for 2012-13 and 2013-14 — this is still a topic for discussion within the Multi Party Climate Change Committee;
- a more stringent long term emissions target (revised to 80 per cent below 2000 emissions by 2050);
- establishing the Carbon Farming Initiative as a source of emission offsets for compliance under the CPM; and
- narrowing the range of emission activities that count toward the 25,000 tonne obligation threshold, with the effect of reducing the number of liable parties to around 500 (compared to 1000 under the CPRS).

Details of these changes and other elements that comprise the government's new proposal for a domestic carbon pricing mechanism are provided in Appendix 1. Importantly, the decision to exclude agricultural emissions from carbon tax and emissions trading arrangements reflects the dispersed and variable nature of emissions within the sector, and the inability to find a reliable, low cost way of measuring emissions output. Broad based and mandatory participation under an emissions trading system is not easily achieved for this sector for this reason. To do so would impose measurement, reporting and verification (MRV) costs on producers that, on a per unit of emissions basis, far exceed those associated with energy or industrial emissions.

Treasury analysis of impacts of the CPM

An Australian Treasury report on the expected economic impacts of the CPM was released in conjunction with the government's Clean Energy Future package. That report, titled '*Strong Growth, Low Pollution*', provides an overview of current international commitments to emission reduction and macro-economic and sectoral impacts for Australia flowing from the introduction of the CPM. Although the price levels and exemptions that it models do not exactly match those of the CPM proposal, they are close enough to indicate the key implications of the proposal. Treasury notes that:

' The economy-wide modelling contained in the modelling report does not include all elements of the final policy package as agreed by the MPCCC. For example, in addition to the slightly lower start price, the core policy scenario assumes unlimited international permits over the entire period, a binding 100 per cent facility allocation cap and that heavy on-road vehicles are subject to an effective carbon price from 2014-15.

Even so, it is expected that the outcome of any updated modelling would closely match the results of the core policy scenarios.'

Treasury (2011), Strong Growth, Low Pollution — Modelling a Carbon Price, Commonwealth of Australia, Canberra, p.74.

Importantly, the Treasury economic modeling utilises two general equilibrium models. The first is GTEM, a model of the international economy developed and used extensively by ABARE to analyse the impact of global greenhouse emission reduction efforts. The second is MMRF, a detailed and widely known model of the Australian economy (and those of States and Territories) that can

be calibrated to estimate greenhouse gas emissions, and also draws directly on the international price and production changes generated by GTEM.[6]

The depiction of ongoing international emission reduction action — in line with Copenhagen pledges made by 89 major nations representing 80 per cent of global emissions and 90 per cent of the global economy following the UN Climate Conference in December 2009 (COP15) — and the economic changes that flow from that, including an operational international market for tradable emission units beyond 2012, is a critical backdrop to the domestic modeling exercise.

Two scenarios are reported by Treasury — depicting differing degrees of international mitigation effort:

Core policy scenario — which assumes a world with a 550 parts per million (ppm) stabilisation target and an Australian emission target of a 5 per cent cut on 2000 levels by 2020 and an 80 per cent cut by 2050. Also assumes a nominal domestic starting price of $20/t CO2-e in 2012-13, rising in real terms by 5 per cent per year, before moving to a flexible world price in 2015-16, projected to be around $29 per tonne CO_2e; and

High price scenario — which assumes a world with a 450 ppm stabilisation target and an Australian emission target of a 25 per cent cut on 2000 levels by 2020 and an 80 per cent cut by 2050 (in line with Australia's upper end and conditional Copenhagen pledge). Also assumes a nominal domestic starting price of $30/t CO2-e in 2012-13, rising at 5 per cent real per year before moving to a flexible world price in 2015-16, projected to be around $61 per tonne CO_2e.[7]

Key macro-economic outcomes and sectoral impacts to emerge from the Treasury modeling are reported in Table 2.2. Results depict outcomes under the CPM as the difference between the CPM outcome and the projected (base case) outcome for Australia in the absence of the CPM, divided by the base case outcome. That is, they report the change in outcome induced by the CPM as a percentage change for the year in question. For instance, a predicted -0.5 per cent reduction in GDP in 2020 due to the CPM mean that's GDP in that year will only reach 99.95 per cent of the value that would otherwise be achieved.

An update of CPM modeling and other variations being considered by the Multi-Party Climate Change Committee was released by Treasury on 21 September 2011. Importantly, Treasury's updated headline macro-economic impacts do not differ from those reproduced in this report.[8]

An interesting outcome of the Treasury CPM modeling is the prediction that agricultural output will expand slightly as a result of the domestic carbon price.

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[6] GTEM is an abbreviation of Global Trade and Environment Model, and MMRF stands for Monash Multi-Regional Forecasting. The greenhouse gas enhanced version developed and operated by the Centre of Policy Studies at Monash University (Melbourne) is MMRF-Green.

[7] See Treasury (2011*), Strong Growth, Low Pollution — Modelling a Carbon Price*, Commonwealth of Australia, Canberra, p.73.

[8] See Treasury (2011), Strong Growth, Low Pollution – Modelling a Carbon Price: Update (21 September), Canberra.

For 'sheep & cattle' the core policy scenario suggests that output will grow by about 0.3 per cent relative to its expected level in 2020, and be 0.5 per cent bigger in 2050. Output from the 'meat products' industry is also stimulated, being about 0.2 per cent bigger in 2020 as a result of changes driven by the CPM.[9]

Table 2.2 Treasury estimates of key Australian macro-economic impacts of the CPM

	2020		2050	
Indicator	Core policy	High price	Core policy	High price
	Percentage deviation from baseline projection			
Gross National Income (GNI)	- 0.5	- 1.4	- 4.7	- 7.1
Gross Domestic Product (GDP)	- 0.3	- 2.8	- 0.9	- 4.7
Terms of trade	0.0	- 0.1	- 0.2	- 0.2
	Industry output			
Mining	- 0.8	- 1.2	- 4.3	- 7.9
Manufacturing	+ 0.2	+ 0.6	- 2.8	- 4.6
Construction	- 0.9	- 2.1	- 5.6	- 8.5
Services	- 0.3	- 0.8	- 1.2	- 1.8
Agriculture	+ 0.4	+ 0.6	+ 1.7	+ 1.9
- Sheep & cattle	+ 0.3	+ 0.6	+ 0.5	+ 0.6
- Dairy cattle	+ 0.2	+ 0.3	+ 2.2	+ 2.5
- Other animals	+ 0.4	+ 0.8	+ 2.2	+ 2.0
- Grains	+ 0.5	+ 0.8	+ 1.1	+ 1.2
- Other agriculture	+ 0.2	+ 0.1	+ 1.3	+1.4
- Meat products	+ 0.2	+ 0.3	+ 1.1	+ 1.1

Source: Australian Treasury (2011), Strong Growth, Low Pollution – modelling a carbon price, Tables 5.1, 5.4, 5.6 and 5.7.

This outcome is principally due to the impact of the CPM on emission intensive exports and flow on implications for the exchange rate. Shielding agriculture from carbon costs on animal, crop and land-based emissions and from on-farm liquid fuel use significantly reduces the burden of carbon pricing relative to other emission intensive sectors.

Treasury notes that:

'… Relative carbon intensity affects how industries respond to pricing carbon. For example, pricing of fugitive emissions in coal and gas production slows their output

[9] Put another way, if the meat processing industry was expected to have an output of 100 units in 2020, the modeling results suggest that, in the absence of other influences, the CPM would cause the output of the industry to increase to 100.2 units.

and export growth. This tends to lower Australia's exchange rate, making other trade-exposed industries more competitive. Slower productivity growth in carbon-intensive sectors slows growth in wages and costs of production in other parts of the economy. Other industries grow faster, if they are outside the scope of carbon pricing, engage in assisted emission-intensive trade-exposed activities or have relatively low carbon intensity.

Agricultural activity emissions are assumed to be excluded from carbon price coverage in both policy scenarios. The carbon intensity of agriculture, forestry and fishing ranges from potentially negative in forestry, to relatively low in grain production, through to highly emission-intensive sectors such as cattle grazing. As agricultural output is traded, the industries gain a competitive advantage from lower wages and exchange rates in the carbon pricing scenarios, and all parts of the sector grow more rapidly.'

Treasury (2011), *Strong Growth, Low Pollution — Modelling a Carbon Price*, Commonwealth of Australia, Canberra, p.99.

This highlights a major advantage of general equilibrium modeling — the capacity to capture the macroeconomic and inter-industry impacts of a policy change. Factors such as exchange rate movements, wage pressures and capital requirements are reflected in economy-wide models, but frequently omitted in 'bottom up' analysis which is not equipped to deal with the dynamics of adjustment and change on a macro scale.

However, data aggregation and the broad brush nature of economy-wide models means that they can often miss important detail. The 'average' combination of inputs that defines production within an industry will often fail to capture the actual diversity of techniques and outputs that exists within a broad industry grouping. Similarly, without specialised knowledge it can be difficult for modelers to accurately depict the incidence of policy changes that affect a myriad of specific products, inputs and facilities across the economy.

The challenge is to inform the modeling with as much industry specific detail as possible, and consider the economy-wide modeling results in the context of particular markets and producers. What do the CPM and the Treasury modeling mean for the Australian red meat industry in particular?

2.3 Carbon cost exposures: what's in and out

As highlighted above producers and processors will face different carbon cost exposures under the CPM, and the CPM applies a different set of liability rules to the CPRS which affects how many emitters will be required to buy emission allowances under the new scheme to cover their direct emissions output. Moreover, while the *Clean Energy Future* announcement purported to exempt agricultural fuel use from direct emission costs, the extension of carbon costs to combustion of aviation fuel runs counter to this.

While aviation fuel represents a small component of costs for agriculture as a whole, for the northern beef industry which commonly uses helicopters to muster cattle and control feral pests in the rangelands of Western Australia, Queensland and the Northern Territory, it is much more significant.

The Civil Aviation Safety Authority (CASA) register indicates that there are 539 fixed and rotary wing aircraft registered in the Northern Territory alone, of which 159 are helicopters.[10] Many of these are owned by cattle stations, while others are operated by contractors who service the cattle industry. These activities are highly fuel intensive and likely to be significantly affected by emission imposts on avgas. Given that the 'air transport' industry in the Treasury model, and other economy-wide models using the standard ABS input-output dataset, is dominated by commercial airline services (ABS data suggest that about 72.5% of services provided by the 'air transport' industry are consumed as commercial and recreational travel), the cost impacts for this industry are likely to be a very crude approximation of cost impacts on operators servicing the needs of the cattle industry, and other agricultural producers (eg. aerial crop dusting).[11]

Agricultural activities that are heavy users of aviation fuel, or services reliant on aviation fuel, will be at a carbon cost disadvantage relative to other producers in the industry who muster or deal with pests using ground based vehicles and equipment. The northern beef industry will be impacted (see section 4.4 for a further discussion of farm level impacts) via an increase in the cost of avgas. So will other activities that are significant users of aerial services — such as aerial spraying.

Table 2.3 indicates the pattern of exemptions and remaining carbon cost exposures for meat producers and processors under the CPM. As noted, farm exemptions for agricultural emissions and fuel use substantially alleviate carbon costs, but a range of upstream costs remain.

Electricity generators will pay for their greenhouse gas emissions as an additional cost of production, and this will flow through to all end users. After two years, under the current CPM proposal, the cost of emissions will also be loaded into the cost of road freight via fuel excise arrangements.

Light vehicle users will be largely exempt from emission costs associated with combustion of fuel (and agricultural producers will have their transport fuel exemption extended to all their off-road vehicle use), with significant carbon price shielding being provided to production in local refineries. A degree of carbon cost pass through can be expected for all goods and services produced in Australia, with the degree of pass through determined by the competitive conditions in each industry, EITE subsidies and exposure to import competition and international prices.

Finally, the Table highlights the potential liabilities that meat processors can face from emissions associated with their wastewater and refrigeration gases

[10] As at 12 August 2011, http://casa-query.funnelback.com/search/search.cgi?collection =casa_aircraft_register

[11] ABS data for 2006-07 (released 23 December 2010) indicate that of the $27,651 million worth of services generated by the Australian 'Air and Space Transport' industry, $20,053 million was consumed by Australian households ($11,146m), Wholesale trade ($1,013m) and Retail ($375m), with an additional $7,519m being sold as Exports. 'Sheep, Grains, Beef and Dairy Cattle' consumed $59m of the output of this industry, while 'Other Agriculture' consumed an additional $63m. See ABS 5209.0 (National Accounts – Input-Output tables).

(the cost of refrigerant gases are likely to increase in line with their global warming potential and reclamation value).

Table 2.3 Checklist of emission cost exposures for meat producers and processors

Emission intensive product/ activity	Grazing & feedlots	Meat processing
U = upstream emissions charge threshold calc and exemptions; S = adds to CPM liability; P = production cost pass thru, subject to mkt conditions; E = excluded (no cost impact); NA = not applicable ** Direct emissions result in an actual obligation to surrender emission allowances where relevant emissions exceed 25,000 tonnes CO_2e pa.		
Light vehicle petrol and gas consumption	P	P
On-site heavy vehicle petrol/ diesel consumption	P	P, U
Aviation fuel (eg. heli-mustering)	P, U	NA
Other liquid fuel consumption	P, U	P, U
Combustion of coal (eg. boilers)	P, S**	P, S**
Combustion of pipeline gas	P,U,S**	P,U,S**
Combustion of LPG, LNG, CNG	P, U	P, U
Grid connected electricity	P, U	P, U
Animal emissions (enteric fermentation)	E	E
Manure decomposition emissions	E	E
Nitrogenous fertiliser use	P, E	NA
Land clearing and forestry activity	E	NA
Leakage of refrigeration gases	NA	P, U
Emissions from sewage and waste ponds	NA	S**
Domestic freight	P, U	P, U
Other inputs — goods & services	P	P

no cost impact indirect cost impact significant cost impact

Counts toward 25 Kt CO_2e threshold for CPM emission liabilities

An important dimension of the changes announced under the CPM is the redefinition of emissions that count toward the 25,000 tonne CO_2e emission

obligation threshold. Under the CPM, combustion of fuels that have the carbon price applied to them via existing fuel excise arrangements rather than through the new carbon price mechanism legislation will not count toward the liability threshold.

Other sources not explicitly covered by the CPM (such as refrigerant gases) will also be excluded from the threshold calculation. A Fact Sheet released in support of the Clean Energy Future package makes this clear, noting that a liability under the CPM can arise for those who …

… operate any facilities that have over 25 kilotonnes of direct (scope 1) emissions after deducting emissions from:

- *liquid fuels, LPG, CNG and LNG;*
- *synthetic gases (excluding PFCs from aluminium smelting); and*
- *decommissioned coal mines.*

Clean Energy Future Fact Sheet (2011) — 500 Biggest Polluting Companies, p.2

This is the change that reduces the number of entities that are required to buy (and surrender to government) emission allowances from 1,000 under the CPRS to around 500 under the CPM. It is possible that a range of meat processors whose emissions pushed them over the obligation threshold under the CPRS, will now be below the threshold under the CPM. Processors in this position will not bear costs associated with their wastewater emissions. This can confer some competitive advantage over larger operators who are required to purchase allowances to cover their on-site emissions output.

These issues, and a detailed analysis of carbon cost impacts, are taken up in the following chapters.

Chapter 3

Detailed modeling of the CPM

Analysis released in support of the Clean Energy Future package and the CPM provides scant detail on the impacts likely to be experienced by different groups within the Australian red meat industry, and the sensitivity of these outcomes to changes in policy settings and real world factors. These issues are examined through new modeling incorporating specific detail of the input mix for key activities. The MMRF-Green model was applied to provide general equilibrium analysis comparable to that undertaken by the Treasury.

3.1 Policy scenarios and settings

A key task within this study is to verify and examine the detailed impact of the proposed carbon price mechanism on beef and sheep farmers, feedlots and meat processors. In the first instance, this means testing and reproducing the government's modeling of the CPM and its industry impacts.

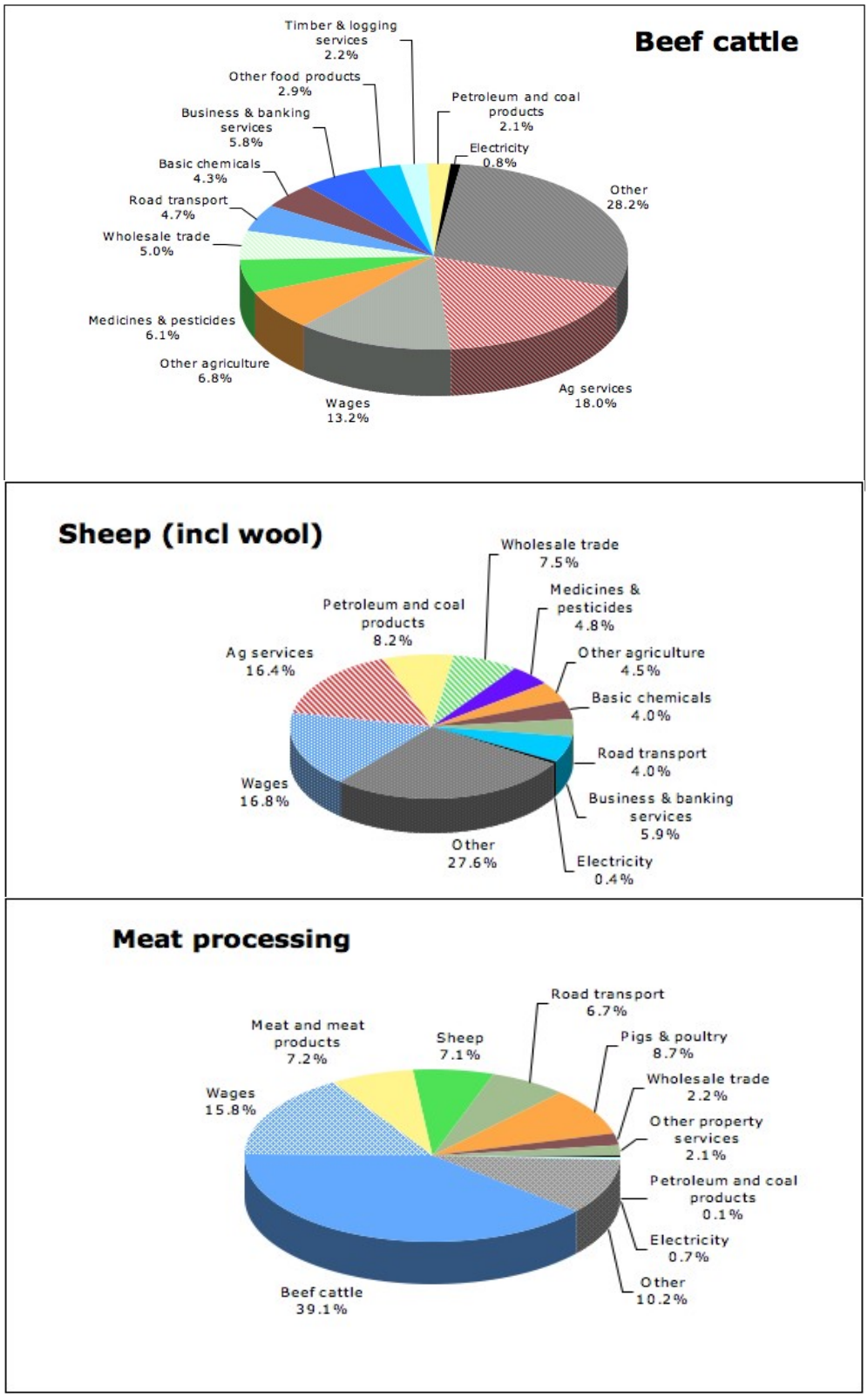
For this exercise, the Centre of Policy Studies (COPS) at Monash University was contracted to model the CPM proposal and report on its detailed industry impacts, using additional economic information on the red meat industry obtained for this study. A detailed profile on industry resource use and output values was conveyed to COPS so that they could more accurately depict the input-output requirements of key activities within the sector, and their greenhouse gas emission signature. This information is provided in Appendix 2 of this report. It allows general equilibrium economic analysis, directly comparable to that generated by the Treasury, for:

- grass fed cattle production;
- grain finished cattle production;
- sheep production; and
- red meat production from the processing sector.

A snapshot, derived from the national accounts, of the production mix for the sheep and cattle sector (combined) and meat processing is provided in Figure 3.1. This is the starting point for input-output analysis and the dataset applied in economy-wide general equilibrium modeling. Additional industry specific detail is provides in Appendix 2.

Analysis from the MMRF-Green model of the Australian economy is a highlight of this study. This is one of the most sophisticated and detailed tools available for computable general equilibrium modeling in the country, and is one of the best documented and well regarded. It is also the basis for the MMRF model used by Treasury to examine the CPM. Although, it is possible that Treasury has undertaken some in-house development and customisation of their version of MMRF, the fundamental differences between the Treasury model and MMRF-Green are likely to be small.

Figure 3.1 ABS cost shares of major inputs to Cattle, Sheep & Meat Processing (2005-06 input-output data)



Source: ABS National Accounts – 2005-06 input-output tables (Cat. 5209.0)

The Treasury modeling also employs GTEM (a model of the international economy) to forecast demand and price conditions in the world economy and use these as an input to its version of MMRF.

For this study, we have taken the international settings and outcomes reported by Treasury as exogenous to the Australian economy. That is, these are 'givens' for the domestic economy and Australian policy settings and cost changes have an immaterial impact on world prices and growth. This 'small country' assumption is commonly applied in trade and competition analysis for Australia and provides a good approximation of price and trade outcomes for virtually all Australian industries, with possible exceptions being coal and aluminium.

COPS' past experience and expertise in climate change policy analysis, including linking the outputs of GTEM and MMRF-Green, allows us to calibrate the MMRF-Green model to the Treasury analysis and approximate the assumptions around international growth and climate action for this exercise.

Background outcomes and policy settings

In line with the Treasury modeling, an initial backdrop of cohesive international greenhouse reduction action is applied. This assumes that other nations will follow through on the lower end pledges they made on mitigation targets and timetables under the Copenhagen Accord.

A summary of the key international outcomes, used as a backdrop to the domestic policy scenarios, is provided in Table 3.1. Crucially, they reflect international abatement efforts linked to a 550 parts per million global greenhouse gas emissions target for 2050 and the ongoing availability of a robust international emissions trading market. They depict a 'projected' policy background for the MMRF modeling in which:

- abatement action sees emissions global greenhouse gas emissions are 32 per cent lower than 2001 levels by 2050;
- the world economy averages growth of around 3.5 per cent (real) between now and 2020, and 3.4 per cent to 2050;
- the international price of CO_2 emission allowances is about A$26 in 2016, rising to US$33 in 2020 and to US$100 by 2050 (in current value dollars); and
- there is ongoing technical advancement that improves the economic viability of significant abatement technologies (such as carbon capture and storage) over the next decade.

In addition to these international settings, the base case also reflects some continuing mitigation action in Australia — in line with greenhouse measures already in place (eg. the 20 per cent enhanced renewable energy target). These see Australia's greenhouse gas emissions rise to around 679 Mt CO_2e in 2020, and 1008 Mt CO2e in 2050. Business-as-usual GDP growth averaging 3.0 per cent per annum for the decade from 2010 to 2020 is projected, and 2.6 per cent per annum for the period 2020 to 2050.

Table 3.1 — International action and emissions market outcomes

Parameter	2020	2050
Global GHG emissions (rel. to 2001 CO_2e)	+39%	-32%
Global World Product – annual avg growth rate (2010-20 and 2020-50)	3.5% pa	3.4% pa
International emissions price (per tCO2e) $US (2010)	US$33	US$100
International price in 2016 $A (2010 dollars)	A$26 (A$29 nominal)	-
Agricultural emissions deviation from baseline (Ag exposed to C-price from 2031)	0%	-30%
Rate of Autonomous Energy Efficiency Improvement (2010-20 and 2020 to 2050)	0.5% pa	0.5% pa
Energy technology 'learning rates' (Table B24)	Various About 1.6% pa	Various About 1.6% pa
Carbon Capture & Storage (CCS) becomes economic after 2021, with a capture efficiency of 90% of emissions. Threshold prices for uptake in the generation sector are: $31/ tCO2e for coal CCS and $38/ tCO2e for gas CCS. ($US 2010)		

* Applies 2010 A$/ USD exchange rate of 0.9.

Source: Australian Treasury (2011), Strong Growth, Low Pollution – modelling a carbon price

Given the fledgling and uncertain impact of the Carbon Farming Initiative (CFI) as it rolls out, no attempt was made to reflect it specifically in this exercise, other than mirror Treasury's assumption of its net impact on Australian base case emissions. That is, a reduction in national emissions of about 7 million tonnes a year by 2020, about 2 million tonnes of which comes from changes in animal production and cultivation practices.[12] Even if these revenues were available at no cost to the sector (ie at zero investment requirement) they would not materially affect the industry specific results. The economic pay-offs and likely effectiveness of the stream of complementary assistance and adjustment measures announced as part of the Clean Energy Futures package is also an area open to significant speculation and analysis, and has been set aside in this study which focuses on the dominant new policy — the CPM.

Estimating the likely pay-offs and impacts of the Carbon Farming Initiative and the subsidies and leverage funds announced by government, represents an in-depth study in its own right.

[12] See Treasury (2011), ibid. Table 4.3. Note that the Treasury's assumption of full export of CFI abatement credits is likely to be invalid under the new CPM arrangements in which Kyoto-consistent CFI abatement can be used for domestic compliance, and counts toward our national emissions target. This assumption does not appear to have been updated in the modeling supplement released on 21 September 2011.

Added red meat industry detail

The modeling is also guided by additional detail on input requirements for particular activities. For beef and sheep meat, it was possible to extract data on the average requirements of producers from the Agsurf and MLA Farm Survey information held by ABARES. Given that similar detail was not available for red meat processors, production requirements (to produce $1 worth of industry output) depicted for 'Meat Products' in the national accounts was used as a default — calibrated to reflect red meat as representing about 80 per cent of output from that industry and about 95 per cent of its exports (by value). Full details are provided in Appendix 2.

Table 3.2 provides important information on the reliance that different activities within the industry have on emission intensive, and other inputs. The information has been obtained from the ABARES AgSurf and Farm Survey database, and reflects the level of detail and reliability of information contained there. While electricity can be separately identified, disaggregation for LPG, LNG, transport fuel and fuel oil is not possible within these datasets. These elements are variously combined under 'fuel' costs, and their use can differ across activities. Unfortunately, the ABS input-output data set also aggregates LPG within petroleum products, and it is not possible to split out this gaseous fuel.

Table 3.2 Domestic animal production: key input shares, 2009-10

Input	Cattle – grass fed	Cattle grain finished	Sheep meat
	% of input costs (Avg 5 yrs to 2009-10) – Agsurf & Farm Survey data		
Electricity	0.8%	0.2%	1.1%
Fuel & grease	5.8%	0.6%	7.0%
LPG/ natural gas	na	na	na
Chemicals & fertiliser	3.9%	0.2%	13.3%
Petroleum	na	na	na
Road transport	3.4%	0.7%	2.7%
Aviation fuel (heli-mustering)	Nthn cattle (no specific data)	0	na
Hired labour	4.9%	2.4%	7.9%
Animal purchases	17.6%	66.9%	12.3%
Interest charges	9.5%	0.9%	10.1%
Professional services ……	1.6%	0.3%	1.9%
Fodder …….	7.1%	20.0%	4.3%

Source: ABARES Agsurf and Farm Survey data (beef cattle and slaughter lambs)

However, the ABS data do provide information on natural gas supply which amounted to about $1 million of consumption in the sheep industry in 2005-06 and about $2 million for cattle.[13] Further, feedlots contacted as part of this study indicate that a medium sized feedlot (with a throughput of around 30,000 head of cattle per year, and which uses steam flaking for its grain) will run up LPG costs of around $320,000 to $350,000 per year.

Lamb production has a higher electricity cost share than either grass-fed cattle or feedlots, with about 1.1 per cent of costs due to their electricity consumption. By comparison, the share for grass fed beef is 0.8 per cent, and 0.2 per cent for grain finished. Chemical & fertiliser costs are also higher for sheep meat production and grass fed cattle (13.3 per cent and 3.9 per cent) compared to grain fed (0.2 per cent). The data also indicate the higher exposure of grass-fed cattle producers to road transport costs (3.4 per cent of costs, compared to 2.7 per cent for sheep meat producers and 0.7 per cent for feedlots). As might be expected, animal purchases and feed costs dominate expenditures for feedlots. Importantly, there is little disaggregation of fuel use by type, and potentially significant levels of expenditure by lotfeeders on gas and other energy sources for boiler-firing are not coming through in these 'industry average' data.

Carbon costs will affect these activities differently, in line with their reliance on emission intensive inputs and the imposts that apply to them.

Scenario 1 – the proposed CPM (Sc.1)

Scenario 1 (Sc.1) reflects the introduction of the CPM, as described in the government's Clean Energy Future package (and outlined in the previous chapter). In combination with 'base case' policies, it achieves an emissions outcome in 2020 that is 5 per cent below Australia's 2000 emission levels — through the use of a government mandated domestic price initially, and subsequent access to an international emissions trading market. Via this mechanism, cheaper offshore emission reductions or entitlements can be purchased and counted toward Australia's target. A linear target trajectory beyond 2020 is assumed, consistent with achieving a national emission outcome 80 per cent below 2000 levels by 2050.

Industry exemption and subsidy arrangements applying to agricultural producers, petrol, the road transport sector and emission intensive, trade exposed industries are in line with government's proposed design for the CPM. Similarly, emissions rebates of up to 94.5 per cent for highly emission intensive trade exposed activities are also modeled. These are assumed to decline at 1.3 per cent per annum until 2022, then phase to zero over the following 5 years.[14]

Scenario 2 — CPM, with extended fuel exemptions (Sc.2)

Scenario 2 (Sc.2) mirrors Scenario 1 except that:

[13] See ABS 5209.0.55.001 Australian National Accounts: Input-Output Tables - Electronic Publication 2005-06

[14] Two tiers of EITE rebate rate are defined, 94.5% and 66% — with the higher rebate applying to activities with emission intensity above a specified threshold.

- the 2 year exemption for heavy transport fuel is extended until 2025, and
- agriculture's consumption of avgas (used in heli-mustering and contract air services) is also exempt from the carbon price, as an extension of the liquid fuel exemption for agriculture.

3.2 Australian base case outcomes to 2030

The assumptions outlined above with respect to international action and business as usual implementation of Australia's current set of greenhouse measures, lead to a set of macro and industry outcomes as described in the following tables. These represent the economy in the absence of the CPM. Changes induced by the CPM are measured against these business-as-usual outcomes.

The base case sees Australian gross domestic product (GDP) grow by about 34.6 per cent between 2010-11 and 2020-21, to a level of about $1,657 billion (in 2010 dollar terms). Under this business-as-usual domestic setting, national exports reach around $372 billion in 2020, and net national output of greenhouse gas exceeds 666 Mt CO_2e in that year.

Table 3.3 BASE CASE — Macro-economic projections (in 2010 dollars)

Economic indicator	Base case outcomes (equivalent to Treasury moderate global action scenario)			
	2015	2020	2025	2030
GDP growth from 2010 (%)	17.7%	34.6%	53.1%	73.9%
Gross Domestic Product (2010 $b)	$1,448.9	$1,656.7	$1,884.0	$2,140.8
Real Private Consumption (2010 $b)	$778.0	$905.7	$1,021.4	$1,137.8
Employment ('000)	11,971	12,725	13,430	14,145
Exports (2010 $b)	$308.1	$371.9	$440.9	$527.0
Imports (2010 $b)	$382.8	$420.7	$463.7	$512.1
GHG output (Mt CO_2e)	609.0	666.5	724.3	800.1

Source: *MMRF Green modeling*

Tables 3.4 to 3.7 provide base case information for the cattle, sheep and red meat processing industries. Grass fed and grain finished beef cattle are shown separately. The real value of output from the grass fed cattle sector is (in the absence of new or unexpected events) projected to grow by about 21 per cent by 2020, and be 57.2 per cent bigger by 2030. Similar growth is expected in other areas, with the value of output from red meat processing expected to grow by almost 67 per cent by 2030, to a real value (in 2010 dollars) of about $27.8 billion. This includes exports of around $13.9 billion. Base case projections for live animal exports from the cattle (about $1.2 billion in 2030) and sheep (about $0.47 billion in 2030) sectors are also shown.

Table 3.4 BASE CASE — Grass fed beef cattle

Economic indicator	Base case outcomes (equivalent to Treasury moderate global action scenario)			
	2015	2020	2025	2030
Output growth from 2010 (%)	8.7%	21.1%	38.0%	57.2%
Value of output (2010 $m)	$8,610	$9,362	$10,934	$12,454
Live exports (2010 $m)	$842	$907	$1,039	$1,197

Source: MMRF Green modeling

Table 3.5 BASE CASE — Grain finished beef cattle

Economic indicator	Base case outcomes (equivalent to Treasury moderate global action scenario)			
	2015	2020	2025	2030
Output growth from 2010 (%)	8.3%	18.8%	31.7%	45.2%
Value of output (2010 $m)	$2,291	$2,514	$2,787	$3,072
Live exports (2010 $m)	-	-	-	-

Source: MMRF Green modeling

Table 3.6 BASE CASE — Sheep production

Economic indicator	Base case outcomes (equivalent to Treasury moderate global action scenario)			
	2015	2020	2025	2030
Output growth from 2010 (%)	8.8%	21.3%	38.3%	57.5%
Value of output (2010 $m)	$4,497	$5,013	$5,717	$6,510
Live exports (2010 $m)	$299	$338	$390	$466

Source: MMRF Green modeling

Table 3.7 BASE CASE — Red meat processing

Economic indicator	Base case outcomes (equivalent to Treasury moderate global action scenario)			
	2015	2020	2025	2030
Output growth from 2010 (%)	8.3%	22.4%	42.7%	66.9%
Value of output (2010 $b)	$18,038	$20,394	$23,776	$27,808
Red meat exports (2010 $m)	$5,297	$6,641	$9,760	$13,866

Source: MMRF Green modeling

These figures represent the 'baselines' for these activities. The impact of the CPM (Sc.1) and 'extended diesel rebate (Sc.2) is expressed in terms of the change generated around these outcomes for each activity, as depicted in Box 3.1.

Box 3.1 Interpreting CGE 'deviations from the base case'

CGE analysis projects a 'baseline' set of outcomes that can represent business as usual or a view of likely future developments. The baseline captures the economy as it is likely to look (at a high level) under the influence of factors reflected in the baseline assumptions.

Once a base case has been agreed, the affect of new policies and economic shocks can be estimated. These can be reported in numerous ways including changes in annual growth rate, increases or decreases relative to today's values (eg. 'in the base case 10,000 more jobs are expected by 2020, whereas under the new policy 15,000 more jobs are expected') or as a percentage deviation from the base case.

Deviation from the base case is most common, and is used in this report. Simply put it is the percentage change in base case outcome that occurs as a result of the policy shock being tested. This result is reported at regular intervals. It is an indicator of how much a policy change is expected to change future outcomes, in relative terms.

For instance, under the MMRF modeling base case the value of grass fed cattle production is expected to increase from around $5.6 billion (in 2010) to about $8.61 billion in 2015 and $9.36 billion in 2020, with all values expressed in 2010 dollars (to net out inflation impacts). The CPM is expected to reduce the value of output from this activity by 0.1 per cent in 2015 and 0.1 per cent in 2020. This implies that value of grass fed cattle production that could be expected if the CPM was introduced, would be reduced to 99.9 per cent of its base case value for each of these years — that is: $8.6 billion in 2015 and $9.35 billion in 2020.

3.3 Macro impacts of the CPM

In general, MMRF-Green modeling shows that because domestic final demand is suppressed by the CPM emissions policy, the prices of non-traded goods tend to fall (relative to base case levels where the economy is more buoyant). And because domestic (and international) greenhouse policies lead to a reduction in Australian exports of fossil fuel and relatively emission intensive products (that are not major beneficiaries of free allowances under the EITE provisions), some softening in the exchange rate is also predicted. This softening is exacerbated by offshore purchases of emission permits that are 'imported' to help Australia meet its emissions target.

According to the modeling, about $2.6 billion worth of permits are purchased offshore in 2015, and about $6.5 billion are purchased in 2020. These transactions continue to put downward pressure on our exchange rate. In the modeling, this phenomenon is accelerated after 2022 when compensation to trade-exposed emissions-intensive industries is assumed to be phased out, and costs in these traded-goods industries tend to rise along with others exposed to the carbon price. As the exchange rate falls (below that in the base case), the cost of imports (in Australian dollars) rises, but our exports become cheaper on the world market. For some low emission and emission cost–exempt

commodities, the exchange rate induced export price reduction outweighs the added costs from the carbon price, and export sales increases. However, Australian dollars now buy less on the international market. A range of macro-economic outcomes, from the Sc.1 and Sc.2 simulations, are reported below in Table 3.8. They indicate a contraction in real GDP of around 0.5 per cent in 2020 and 0.7 per cent in 2025, under both scenarios.

Table 3.8 Macro-economic impacts — deviation from base case

Economic indicator	(Sc. 1) CPM proposal				(Sc.2) Extended road freight rebate & Ag avgas			
	2015	2020	2025	2030	2015	2020	2025	2030
	% deviation from base case							
GDP gwth rel 2010 (Sc–Base)/Base %	17.3	33.9	52.0	72.1	17.3	34.0	52.0	72.1
Real Gross Domestic Product (GDP)	- 0.4	- 0.5	- 0.7	- 1.1	- 0.4	- 0.5	- 0.7	- 1.1
Real Gross National Product (GNP)	- 0.4	- 0.6	- 1.0	- 1.7	- 0.4	- 0.6	- 1.1	- 1.7
Real Private Consumption	- 0.4	- 0.7	- 1.2	- 1.9	- 0.4	- 0.7	- 1.2	- 1.9
Employment	- 0.3	- 0.1	- 0.2	- 0.2	- 0.2	- 0.1	- 0.2	- 0.2
Real wage rate	-0.7	-1.2	-1.7	-2.8	-0.7	-1.1	-1.6	-2.7
Exports	+ 0.3	+ 0.2	+ 0.6	+ 0.7	+ 0.3	+ 0.3	+ 0.7	+ 0.8
Imports	- 0.8	- 0.8	- 1.3	- 2.0	- 0.7	- 0.7	- 1.3	- 1.9
Exchange rate	- 0.8	- 0.9	- 1.6	- 2.5	- 0.7	- 0.8	- 1.6	- 2.5
	Aust consumer prices* — % deviation from base case							
Electricity	19.0	19.6	18.9	26.8	19.0	19.6	19.0	26.8
Coal^	117.7	163.8	222.9	283.3	117.6	163.6	223.0	283.3
Natural gas	7.0	6.9	7.6	9.3	7.0	6.9	7.6	9.3
Diesel	18.5	20.6	25.4	30.4	0.3	0.2	19.9	24.9
LPG	8.6	9.6	12.7	16.3	2.9	3.1	12.4	15.9
Other petroleum	2.9	3.1	4.6	6.4	2.8	3.0	4.6	6.4
Chemicals	0.3	0.2	0.7	1.4	0.2	0.1	0.7	1.4
	Greenhouse emissions trading indicators							
Permits bought offshore (Mt CO2e)	22.6	86.6	163.4	217.8	22.8	86.9	163.6	217.9
Value of permit imports (2010 $b)	0.51	2.58	6.50	11.46	0.51	2.59	6.51	11.47

*Price deviations are relative to a CPI numeraire. They represent the degree of price change relative to price changes expected in the basket of CPI consumer goods tracked in the base case.

^includes brown and black coal, and reflects inclusive cost of Australian emission permit for combustion.
Source: MMRF Green modeling

Gross National Product adjusts for dividends and financing transactions paid overseas, and is a measure of the income from Australian production that is distributed within Australia. The measure indicates a slightly greater reduction in national income due to the CPM, and better captures the effect of offshore emission purchases.

Real private consumption, a common welfare measure, is similarly adversely affected — falling by 0.7 per cent and 1.9 per cent in 2020 and 2030 respectively. This is, real private consumption is only 99.3 per cent and 98.1 per cent of the level it would otherwise be expected to reach in each of these years. Real GDP is 72.1 per cent bigger in 2030 compared to 2010, whereas without the CPM it was expected to be 73.9 per cent bigger.

Extension of the road freight diesel exemption has little material impact on the key macro indicators examined.[15] But it can have a discernible impact at the industry level.

As shown in Table 3.9, industries that are heavy users of road transport, such as cement, benefit most from the extended diesel exemption, and demand for road freight stays strong compared with other modes which bear full carbon costs, and generally pass these on to customers.

[15] The Treasury modeling update (of 21 September 2011), incorporates a comparison of the government proposal for the CPM and that agreed by the Multi-Party Climate Change Committee — including the proposal for a indefinite exclusion of heavy road transport emissions. Like the results shown here, key macro-economic outcomes are not substantially affected (to 1 decimal place), although a higher level of offshore abatement purchases are required to achieve domestic greenhouse targets. Treasury estimates these purchases to increase by about 3 million tonnes CO_2e by 2020, modeling presented here estimates the additional amount at around 300,000 tonnes.

Table 3.9 Major impacts on sectoral and industry output and export performance

Economic indicator	(Sc. 1) CPM proposal		(Sc.2) Extended road freight rebate & Ag avgas	
	2015	2020	2015	2020
	Production — deviation from base case (%)			
Coal mining	-1.2	-3.5	-1.5	-3.5
Gas extraction	-0.5	-1.5	-0.5	-1.5
Non-metallic minerals	-0.7	-0.8	-0.7	-0.8
Cement	-0.8	-1.0	-0.8	-0.9
Aluminium	-2.0	-2.5	-2.0	-2.5
Road freight	-0.3	-0.4	-0.1	0.0
Rail freight	-0.2	0.0	-0.3	-0.2
	Exports — deviation from base case (%)			
Coal mining	-1.0	-3.1	-1.0	-3.1
Gas extraction	-1.2	-2.3	-1.2	-2.3
Non-metallic minerals	+4.6	+5.7	+4.7	+5.9
Cement	+4.5	+5.5	+4.6	+5.8
Aluminium	-6.6	-7.5	-6.6	-7.5

Source: MMRF Green modeling

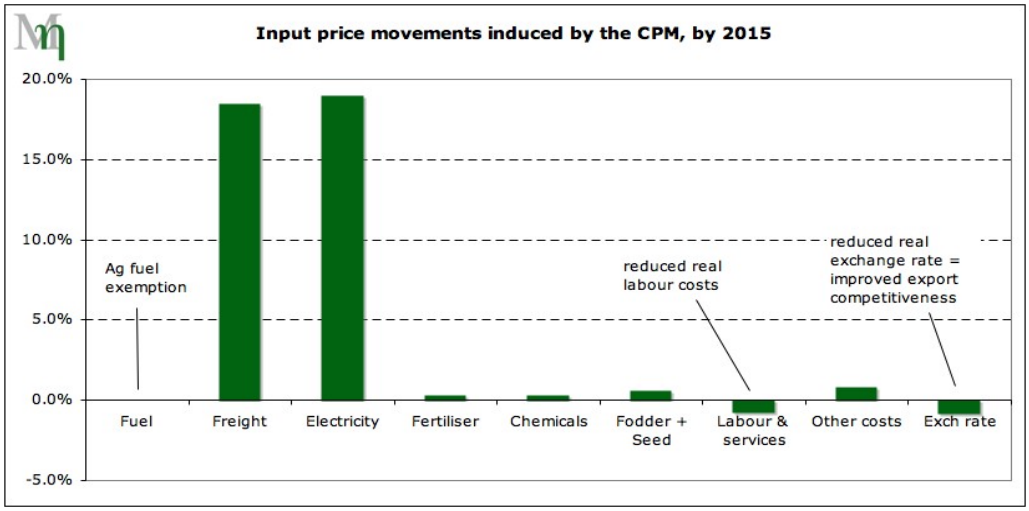
3.4 Impacts on producers and processors

In general, MMRF-Green modeling of the CPM suggests that exemptions for direct emissions plus liquid fuel use tend to buffer the red meat industry from many of the costs borne by other producers in the economy. And declines in the exchange rate tend to outweigh residual carbon costs from a demand perspective. While a lower exchange rate (than the base case) means the cost of imported inputs go up, the Australian red meat industry has a relatively low reliance on these. Non-traded inputs such as wage labour, services and transport are more important, and more affected by domestic supply and demand conditions. **On balance, the modeling suggests — based on industry wide input data — that the competitive impact of the lower exchange rate, plus falls in real wage income, will tend to balance the additional costs faced by the industry.** However, the margin is extremely small, and other factors can significantly affect this outcome.

The price and exchange rate changes that are expected to drive the margins and competitive positions of agricultural producers are shown in Figure 3.2. Under the proposed CPM arrangements agricultural producers will benefit from a

carbon price exemption on their liquid fuel use while other producers, such as meat processors — who are classified as manufacturers for CPM purposes, will be subject to some additional costs in this area — depending on fuel type and usage. Other inputs will not be completely shielded, although some will benefit from free emission allowance allocations designed as production subsidies to emission intensive, trade exposed activities and the ability to access overseas suppliers of these inputs. The price of non-traded inputs such as freight and electricity will be most affected (increasing by 18 to 19 per cent beyond their expected level by 2015), while real wages are expected to fall a little (a reduction of nearly 1 per cent below their expected level by 2015).

Figure 3.2 Expected input price changes affecting agricultural producers under the CPM, by 2015



Source: *MMRF Green modeling*

For all activities modeled, the net impact on production is of the order of 0.1 to 0.2 per cent (relative to the base case), while for grass fed cattle production the impact is a slight contraction in the value of output and live exports from the industry in response to the CPM. These headline impacts for the grass fed cattle producers are shown in Table 3.10. Details of dollar value and employment impacts are provided in Appendix 3.

Table 3.10 Impact on grass fed cattle production — deviation from base case

Economic indicator	(Sc. 1) CPM proposal		(Sc.2) Extended road freight rebate & Ag avgas	
	2015	2020	2015	2020
	% deviation from base case			
Value of output	-0.1	-0.1	-0.1	0.0
Production costs per unit	+0.3	+0.5	+0.3	+0.5
Price per unit (farm gate)	+0.6	+0.7	+0.8	+0.8
Gross Operating Surplus	+0.4	+0.4	+0.7	+0.6
Live exports	-0.4	-0.5	-0.4	-0.5
Employment	+0.5	+0.8	+0.6	+0.9

Source: *MMRF Green modeling*

This reflects the mixed impact of increased sales to the processing sector (which expands its exports under the CPM), a net increase in margins (because farm gate prices for grass fed cattle rise by more than costs per unit) and greater use of labour in production because it becomes cheaper relative to other inputs under the CPM. Overall, cost increases outweigh the impact of the Australian dollar falling (compared to the base case), and livestock exports fall by 0.4 to 0.5 per cent relative to the base case. Although, demand for grass fed cattle (and output) is stimulated by the predicted expansion in Australian processed meat exports, this growth is not sufficient to fully offset the drop in live cattle sales associated with carbon price impacts which see unit costs rise by about 0.3 per cent by 2015 and 0.5 per cent by 2020, plus transport cost impacts.

The nominal exchange rate (which reflects real value movements plus inflationary impacts) is the price that overseas buyers must pay to convert their currency to Australian dollars, and buy Australian goods. In the modeling, the nominal exchange rate falls by less than the real exchange rate, and the depreciation is not sufficient to offset the carbon price induced cost increases for grass fed cattle production. Within the modeling, exports are very sensitive to differentials above or below the prevailing price on the world market — with a 1 per cent price margin above the world price typically resulting in about a 10 per cent reduction in sales.

This combination of factors gives rise to a predicted outcome for grass fed cattle where margins increase (prices rise more than cost) but the gross value of output falls (export volumes decline).

Table 3.11 Impact on grain finished cattle production — deviation from base case

Economic indicator	(Sc. 1) CPM proposal		(Sc.2) Extended road freight rebate & Ag avgas	
	2015	2020	2015	2020
	% deviation from base case			
Value of output	+0.1	+0.2	+0.2	+0.2
Production costs per unit	+0.3	+0.3	+0.3	+0.3
Price per unit (farm gate)	+0.3	+0.2	+0.4	+0.4
Gross Operating Surplus	+0.6	+0.6	+0.9	+0.9
Live exports	-	-	-	-
Employment	+0.7	+1.1	+0.8	+1.2

Source: *MMRF Green modeling*

The gross operating surplus of all red meat industry activities benefits from the extension of the diesel fuel exemption for heavy transport, although its impact on the exchange rate can reduce export expansion relative to the CPM package.

The significant expansion in export of live sheep and processed meat is also notable, growing about 2.2 per cent for live sheep and 2.4 per cent for processed meat beyond the base case projection by 2020. For sheep meat, both the CPM and extended road diesel exemption scenarios (Sc.1 and Sc.2) show

expansion in output, exports and profit. This is principally due to a falling exchange rate and reliance on domestic inputs that are largely non-traded.

Table 3.12 Impact on sheep production — deviation from base case

Economic indicator	(Sc. 1) CPM proposal		(Sc.2) Extended road freight rebate & Ag avgas	
	2015	2020	2015	2020
	% deviation from base case			
Value of output	+0.1	+0.2	+0.2	+0.2
Production costs per unit	+0.2	+0.1	+0.2	+0.1
Price per unit (farm gate)	+0.2	+0.1	+0.3	+0.3
Gross Operating Surplus	+0.6	+0.6	+0.9	+0.9
Live exports	+1.7	+2.2	+1.7	+2.1
Employment	+0.7	+1.1	+0.8	+1.2

Source: *MMRF Green modeling*

As shown in Figure 3.1, about half of the input costs to sheep production are comprised of labour and services, and on farm petroleum use. For sheep production, costs rise only modestly under the CPM (and less under the diesel exemption), and are outweighed by higher export sales and Australian dollar earnings under a falling exchange rate.

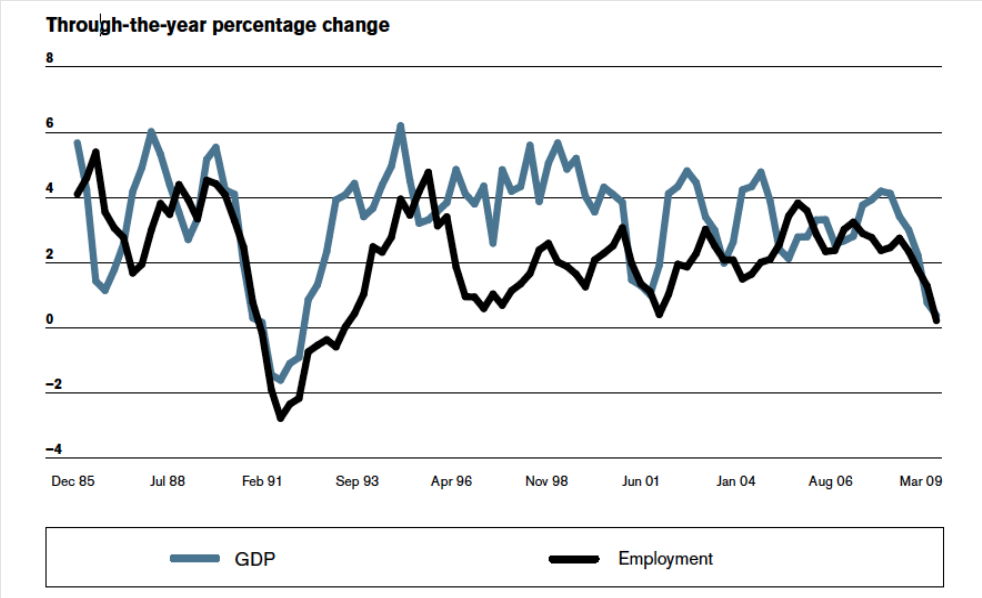
Australia's recent history has shown several periods of reduced real wages as the economy slows or bargaining power has shifted between employees and employers (see Box 3.2). The MMRF modeling suggests that the reduction in growth rate induced by the carbon price will, over time, see a small reduction in the growth of real wages compared to business-as-usual.

For red meat processing, the story is mixed. On one hand, the lower exchange rate boosts meat exports and the earnings (in Australian dollars), but red meat processors also face higher costs that erode their profit margin coupled with a slow down in the Australian economy which reduces domestic sales (below base case levels). As noted above, the cost of domestically sourced inputs that are trade exposed tends to go up as the exchange rate falls. On the other hand, the price of non-traded (low emission intensity) inputs such as labour tends to fall. The meat processing industry also has a heavy reliance on road freight, which is non-traded but heavily emission intensive. Liabilities for waste emissions are also relevant to the cost structure of the 'average' meat processing facility.

Box 3.2 Real wages and demand within the economy

Nominal wages are generally considered to be 'sticky', with employees seldom accepting a reduction in the dollar value of their pay. However, in periods where there is weakness in the labour market, wage restraint nominal wages increases can fall behind inflation, leading to a reduction in real wages. The figure below demonstrates movements in real wages over the period since November 1985. The late 80's were a period of falling real wages, and a similar fall can be seen in the 2008/09 period coinciding with the global financial crisis — a period of weakened demand in Australia and overseas.

Growth in employment and real average weekly earnings, Nov 1985 to Feb 2009



Source: Australian Fair Pay Secretariat (2009), Changes in the Australian Labour Market over the Economic Cycle, June, Figure 3

Overall, production costs per unit of output are predicted to rise by about 0.5 per cent by 2015 and 0.4 per cent by 2020. Alongside this, exposure to export markets means that the full impact of higher production costs cannot be fully passed through to consumer prices (factory gate prices rise by only around 0.4 per cent) and operating margins are squeezed as a result. MMRF-Green indicates a reduction in gross operating surplus of about 0.7 per cent by 2020 under the CPM, and a drop of 0.5 per cent under the extended diesel fuel rebate for road transport.

Table 3.13 Impact on red meat processing — deviation from base case

Economic indicator	(Sc. 1) CPM proposal		(Sc.2) Extended road freight rebate & Ag avgas	
	2015	2020	2015	2020
	% deviation from base case			
Value of output	0.0	+0.1	0.0	+0.1
Production costs per unit	+0.5	+0.4	+0.5	+0.4
Price per unit (at gate)	+0.4	+0.4	+0.4	+0.4
Gross Operating Surplus	-0.6	-0.7	-0.5	-0.5
Exports	+1.8	+2.4	+1.9	+2.6
Employment	0.0	+0.1	0.0	+0.1

Source: *MMRF Green modeling*

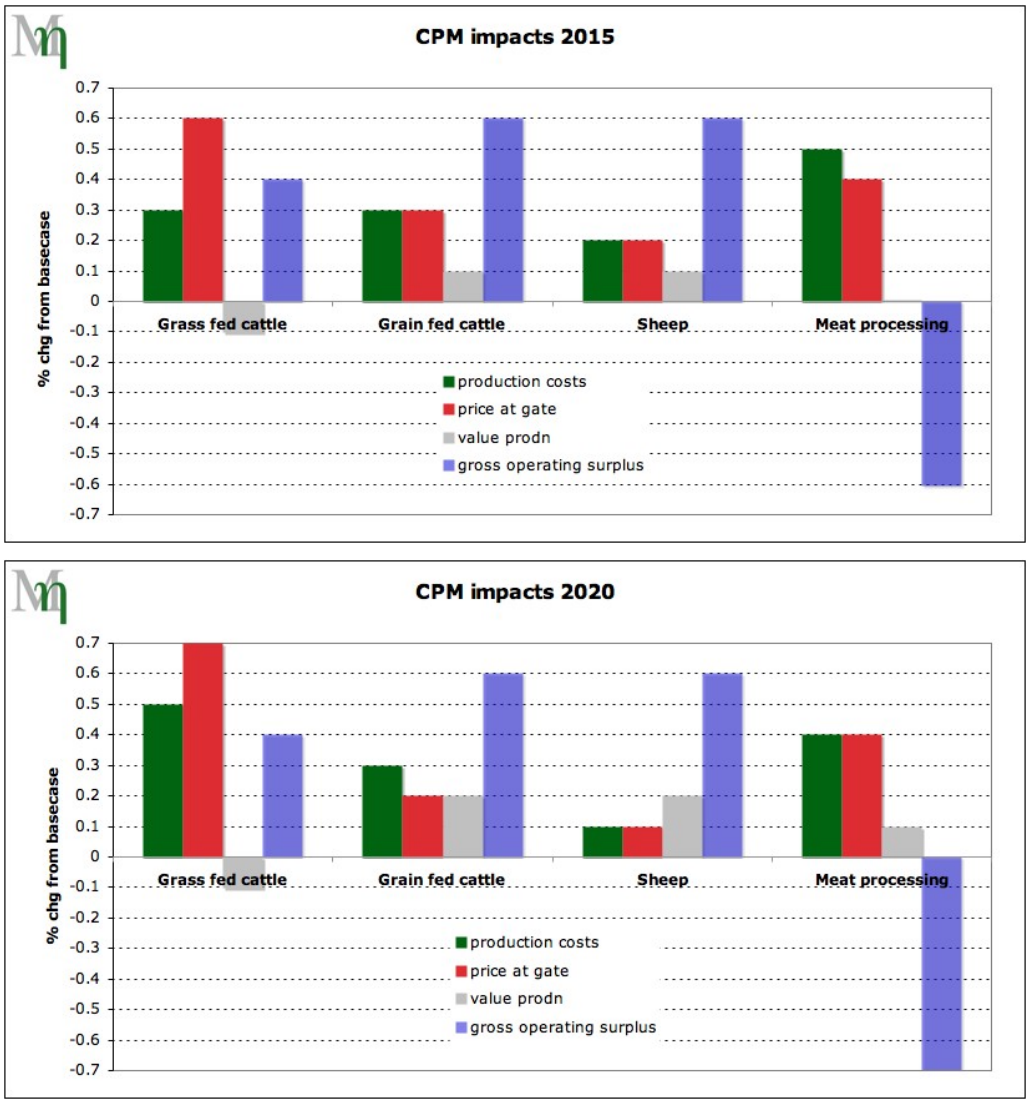
Key observations from the CGE analysis

The MMRF-Green modeling serves as a useful check on the Treasury's published CPM analysis. While overall industry impacts are similar, our own modeling shows a less positive stimulatory impact for the sector overall. This is likely to reflect the influence of less optimistic assumptions on scope and the commodity price impacts of international abatement action and differences in model calibration — with the modeling used in this study using more disaggregated and recent data for cattle and sheep production.

Further, operators in the red meat processing sector are shown to suffer a reduction in profit margins under the CPM. Past work (eg. CIE 2009) has already highlighted the very low profit margins of operators in this industry, and their vulnerability to additional and non-transferable costs.

And while exemptions for direct emissions and carbon costs on liquid fuels tend to insulate the cattle and sheep producers, this buffer is quite small — in output terms, often of the order of 0.1 to 0.2 per cent, with grass fed cattle showing a small overall contraction in output due to the effect of the CPM. While the grass fed sector can expect domestic cattle prices to rise in line with the lower exchange rate and expanded demand for Australian beef overseas, it also has a higher cost exposure than grain fed beef — directly through its higher reliance on road freight, and indirectly through its reliance on trade exposed inputs (such as chemicals). The broad impacts on unit production costs and farm and factory gate prices, relative to expected base case outcomes, are shown in Figure 3.3.

Figure 3.3 Changes in unit costs, prices, operating surplus and output induced by the CPM, 2015 and 2020



Source: *MMRF Green modeling*

The modeling also highlights the relatively benign impact of Sc.2 on the macro variables. It supports slightly stronger aggregate growth and export performance, though it does require the purchase of additional permits from international sources to deliver on Australia's greenhouse target adding upwards of $10 million a year to the requirement for offshore credits. Its contribution to the bottom line and sales of operators in the red meat industry is also a fairly consistent result. The ongoing exemption of heavy road freight from emission costs is clearly beneficial to this group of activities, and for grass fed beef producers — and graziers in Northern Australia — the exemption of aviation fuel helps alleviate some of the residual carbon exposure borne by this activity.

Whereas southern graziers enjoy exemptions on liquid fuel used for mustering and pest eradication, graziers in the north do not extract the same advantage from this benefit because of their greater need to muster from the air, or hire contractors to do this work. This emerges as an apparent anomaly in the CPM proposal, and could be addressed through extending liquid fuel exemptions to

aviation fuel consumed by graziers and their aviation contractors. Similar issues are likely to arise for users of aerial spraying services in the crops sector.

The significant energy requirements of larger feedlots which use steam to treat feed grain can also be important, but glossed over in the standard CGE modeling and data. Carbon pricing will add a suite of new demands on these producers, and historical data sources can readily overlook or under-represent inputs and production relationships that will take on an expanded importance under a carbon pricing regime.

3.5 Beyond the modeling

While general equilibrium modeling is a useful tool for examining the impact of policy changes, like all models it is dictated by the data that it is given and its assumptions. Models like MMRF assume competitive markets and efficient input combinations (at least within the bounds of regulations, taxes and other distortions being applied). They also operate on an aggregated data set that spans a wide range of industries, and produce industry level results.

For instance, the market structures and relationships depicted in MMRF, depict a ruling price for meat and inputs across Australia, and greater scope to push cost forward, rather than backwards along the domestic supply chain. This can significantly impact on who ultimately is required to absorb increased costs along the supply chain. The more avenues for live sheep and cattle exports are restricted, the greater the chance that Australian producers will be obliged to absorb upstream costs. The lack of a strong mechanism within MMRF to reflect cost pass through back up the supply chain, suggests that while production outcomes are likely to be fairly robust, it is likely that modeled price increases (and gains in margins) for cattle and sheep will be over-stated, and cost increases absorbed by processors will not be as large as indicated. This also suggests impacts on processor margins will not be as severe.

Further, without detailed data, and equations to relate that data to production and consumption relationships, CGE models can also overlook the diverse range of input combinations that exist within an industry, and differences in market power. While all production processes in an industry can be summed to estimate total resource input or the average input mix per unit of output, it is important not to lose sight of variation around this mean.

Supply and production relationships can differ significantly on a regional basis, with transport costs and other factors limiting the scope for some producers to access alternative markets and thereby shop around for the better prices. In circumstances where alternative buyers are few and suppliers are many, the buyers are likely to be in a strong position to determine a low price, and protect their margins via this mechanism. Economics suggests that competition is a powerful mechanism for driving prices toward costs, and these costs can differ according to location.

Cost sharing between producers and processors

Previous analysis of the red meat industry undertaken by the CIE (2009) noted that '*... cost increases are ultimately shared between farmers, processors and wholesale consumers.*' The distribution of these costs depends on the product

and relationships in the supply chain. That study suggested that red meat processors could pass between 13 and 38 per cent of carbon cost increases on to Australian consumers given trade and market relationships. For the remaining costs, CIE used the TERM (regional economy) model to investigate the economics of the farmer-processor relationship and concluded that:

'… processors can pass around 80 per cent of the remaining cost increases back to farmers, and that farmers are able to pass around 30 per cent of these remaining costs forward to processors. This amount will clearly vary from region to region and product to product.'

CIE (2009), Possible impacts of the CPRS on the Australian red meat and livestock industry p.19

The following broad characteristics of the industry would support this conclusion:

1. sheep and cattle producers are numerous, and tend to engage in only a modest level of live export activity;
2. there is little or no live trade from the feedlot sector and its key role is to supply the export and domestic meat markets;
3. meat processors are the key buyers of Australian sheep and cattle, responding to demand for red meat in Australia and overseas markets. Exports account for around 60 per cent of output currently; and
4. there are few imports of beef and sheep meat to the domestic market, although imports of pork are more substantial.

However, economies of scale can also be relevant to cost sharing outcomes. For meat processors with substantial fixed costs and who require volume to achieve optimal efficiency, there will be an economic incentive to ensure supply by bidding up prices in the domestic market, or at least moderating the desire to cherry pick suppliers. This dynamic would tend to weaken the position of processors looking to pass higher costs back up the supply chain to farmers.

Further, under circumstances where farmers can export their livestock, a processor's ability to pass increased costs up the supply chain in the form of lower stock prices will be substantially reduced. This is likely to characterise pricing in markets in northern Australia, but be less influential in markets and regions to the south. And switching between markets is not a costless exercise. As demonstrated in Box 3.3, transport costs can significantly curtail the ability of a grazier to sell into distant regional markets or access northern ports that service the live trade.

Box 3.3 Markets and pass through bounded by transport costs

A range of indicative transport costs is presented in the table below to illustrate the possible impacts of the carbon price on transport costs of cattle. From industry information, the usual range in terms of litres used per head transported to an abattoir is of the order of 1 to 5 litres per animal, consistent with a journey of up to 100-200 kilometres. There will be deliveries outside these ranges but it is expected most of them would be of this order. Applying a carbon price of $23 per tCO_2e to the emissions per litre of diesel fuel used in heavy vehicle transport leads to a cost increase for the farmer delivering to the abattoir of between $0.06 and $0.31 per animal with a most likely average of about $0.19 per animal.

Transport cost increase per head due to carbon pricing

Indicative CO_2 price	*Litres of fuel per head*	*Added transport cost per head*
$23.00	1	$0.06
$23.00	3	$0.19
$23.00	5	$0.31
$23.00	13	$0.81

If live cattle export is not an option, then the carbon cost would be shared between farmers and processors according to the relative elasticities of supply and demand. However, if live cattle export is an option, the export alternative sets a floor price for negotiations with Australian processors, though the impact of higher transport costs would need to be factored in.

According to industry sources, cattle can be moved distances of 2000 km at a fuel usage of 13 litres per head using dedicated road trains. The carbon tax on the diesel used would be of the order of $0.81 per head. Holding all other costs constant this transport cost differential (of 0.81 - 0.19 = $0.62) is a measure of the bargaining advantage that a local buyer has over a distant one, and the ability of processors to shift carbon costs onto producers. Other factors such as exchange rate risk, intermediary fees and insurance increase the cost differential and the pool of local supply that is oriented toward established local buyers.

There is no clear resolution to the cost pass through question. It is supply chain specific and therefore likely to vary across processing plants and regions. It is also likely to vary over time in line with seasonal conditions that affect supply. However, as a broad observation it seems reasonable to conclude that CGE modeling is likely to exaggerate the ability of farmers to resist efforts by processors to share their higher costs with them. Based on the CIE work, this 'reality check' might see a reallocation of about half of the carbon costs assumed to be absorbed by processors passed back onto sheep and cattle suppliers, with even greater pressure to share costs falling on grain finished cattle producers whose output is most closely linked to export demand and prices. Similarly, regional factors and sales alternatives for producers can affect cost sharing outcomes between feedlots and their cattle suppliers.

Chapter 4

Important detail at the farm and facility level

Beef and sheep producers operate across a range of scales and locations in Australia. These differences can lead to variation in the combination of inputs used in production, and different degrees of exposure to carbon price pressures. This chapter reviews the cost structure of different operations in the beef and sheep meat industry, and the vulnerabilities faced by red meat processors who face a wider range of direct and indirect cost pressures. Carbon price impacts reported in the previous chapter are applied to the input mix of a range of sample properties representing different producers within the red meat industry.

4.1 Devil in the detail

Previous reports by MLA, AMPC and the Australian Farm Institute (AFI) have highlighted the exposure of different farming and production facilities to carbon costs. MLA's 2009 study of 6 red meat processing plants identified differences in emission intensity and input use that saw the estimated CPRS carbon cost impost vary from $9.40 to $34.60 per tHSCW between plants.

And subsequent studies by AFI focused on beef production and sheep meat using national 'average' data and information for different locations, obtainable from Agsurf and the Farm Survey.[16] For sheep production, AFI (2011a) drew on input data for farms in Western Australia and New South Wales to demonstrate variations around the national trend. For beef production, AFI (2011b) compared national results with producer information for Queensland and Victoria. Scenarios involving exclusion of agricultural emissions and also an exemption for emissions from fuel use were tested.

The 'no fuel' results are most relevant to this exercise. For the low carbon price result (giving medium term prices of $23 to $30 per tonne of CO_2e), beef producers showed a variation in costs of between 0.5 and 0.7 per cent (and a widening gap at higher carbon prices in to the future). For sheep, the costs impost varied between 0.5 and 0.9 per cent. And changes in cash income were more substantial, on the assumption that costs could not be passed on and would need to be fully absorbed.

Although industry-wide modeling might suggest that policy changes are likely to be modest, the distribution of impacts is still important. National policies such as carbon pricing can result in localised pressure and hardship in circumstances where diversity within an industry or region is ignored.

[16] See the ABARES website (http://www.abares.gov.au/)

Variation within sectors

To examine differences in production practices and carbon price exposure, a set of specialised regional activities was constructed with profile information from the ABARES Agsurf and MLA Farm Survey databases. Cost profiles were based on average farm expenditures over the 5 years from 2004-05 to 2009-10.

These sample farming activities are:

For Beef cattle

- BEEF Grass fed - National
- BEEF Grain finished – National
- BEEF – Western Australia
- BEEF – Queensland
- Specialist BEEF (200-400 herd size)

and for Sheep

(the database for Slaughter lambs was used to reduce the impact of wool production on cost estimates)

- SHEEP – National
- SHEEP – WA
- SHEEP – NSW
- SHEEP/ BEEF – Vic
- SHEEP/ BEEF – Qld
- SHEEP (200-500 lambs sold)

Both the 200-400 herd size for cattle and 200-500 lambs sold classifications were selected because these are relatively small operations and account for no more than about 10-15 per cent of supply within the each industry.

Nevertheless, these are amongst the most common farm sizes — these and smaller operations accounting for up to 50 per cent of farming operations. Analysis of the ABARES database suggested the persistence of the '80-20' rule — 80 per cent of the industry is dominated by the largest 20 per cent of producers. This is a common outcome, and highlights the risk of policy development dominated by industry level analysis, particularly in a sector where margins can be modest and regional employment is important.

Cost profiles for these sample operations were matched to estimates of likely price increases under the CPM. A sample of these was reported as part of the macro-results in Table 3.7 in the previous chapter. The set of CPM-induced user price increases for Agricultural producers applied to the sample farm dataset appears in Table 4.1.

Table 4.1 Input price increases facing producers under the CPM

Input	*Cost increase relative to base case*			
	2015	2020	2025	2030
	% deviation from base case			
On-farm fuel* (Ag exempt)	0.0	0.0	0.0	0.0
Freight (diesel)	18.5	20.6	25.4	30.4
Electricity	19.0	19.6	18.9	26.8
Fertiliser	0.3	0.2	0.7	1.4
Chemicals	0.3	0.2	0.7	1.4
Fodder & seed (grain)	0.6	0.6	1.3	2.2
Labour & services	-0.7	-1.2	-1.7	-2.8
Other costs	0.8	0.9	1.6	2.5

Source: *MMRF Green modeling*

4.2 Implications of different production mixes

Differences in input combinations for various activities and locations were accessed via the AgSurf and the MLA Farm Survey databases. The various profiles extracted, averaged over the five years to 30 June 2010 appear below.

Table 4.2 BEEF cattle producer inputs as a share of total cash costs

Input	Beef – Grass (National)	Beef – Grain (National)	Beef – WA	Beef – Qld	Beef - NSW	Beef (200-400 herd)
Fuel* (Ag exempt)	6.2%	0.6%	7.7%	6.2%	6.7%	7.4%
Freight (diesel)	3.6%	0.7%	4.5%	3.5%	3.2%	3.1%
Electricity	0.9%	0.2%	0.7%	0.8%	1.1%	0.8%*
Fertiliser	3.1%	0.1%	14.0%	0.7%	5.8%	6.9%
Chemicals	1.1%	0.1%	4.4%	1.5%	4.4%	4.4%
Fodder & seed (grain)	8.3%	20.1%	5.4%	10.2%	7.6%	7.5%
Labour & services	5.3%	2.4%	8.8%	5.3%	7.0%	5.9%
Other costs	71.5%	75.7%	54.4%	71.7%	64.2%	64.0%
Total avg costs ($'000) pa	*$284.6*	*$21,640.1*	*$440.1*	*$392.9*	*$316.7*	*$201.5*

* electricity share information was not available for specialist beef by herd size. The Queensland share has been used for this cell, as a mid range estimate.

Table 4.3 SHEEP producer inputs as a share of total cash costs

Input	Sheep (National)	Sheep - WA	Sheep - NSW	Sheep/ beef - Vic	Sheep/ beef - Qld	Sheep (200-500 sale)
Fuel (Ag exempt)	7.3%	8.3%	8.0%	5.2%	6.9%	9.1%
Freight (diesel)	2.8%	4.9%	2.9%	2.5%	4.3%	3.7%
Electricity	1.1%	0.6%	1.4%	0.7%	1.3%	0.6%*
Fertiliser	9.5%	20.6%	8.3%	9.4%	0.2%	13.4%
Chemicals	4.4%	10.7%	6.0%	2.7%	0.4%	8.7%
Fodder & seed (grain)	5.7%	2.7%	5.3%	7.3%	6.6%	3.8%
Labour & services	8.3%	7.6%	8.0%	8.9%	12.9%	6.7%
Other costs	60.8%	44.6%	60.1%	63.4%	67.4%	53.9%
Total avg costs ($'000) per year	*$224.0*	*$549.8*	*$351.5*	*$235.9*	*$242.7*	*$235.4*

* electricity share information was not available for slaughter lambs by lamb sales. The WA share has been used for this cell.

Revealed cost variations

Combining producer costs with estimated price impacts from the CPM over the period 2015 to 2025 yielded the cost variations presented in Table 4.4. These represent the percentage cost increase for each producer in the relevant year that would be induced by the CPM.

For cattle production, cost variations in the range of 0.8 to 1.4 per cent were found from 2015 based on the AgSurf and Farm Survey information, with grain finished beef having the lowest emission cost exposure — after taking exemptions for direct animal emissions and emissions from fuels into account. Notably, AgSurf's public data set provides no detail splits between on liquid and gaseous fuel use on-farm, and while assuming the dominance of liquid fuel use (and carbon price exemption) is likely to be reasonable for most farm operations, there are some notable exceptions. This is taken up in a later section.

Costs for grass fed cattle farmers rise as high as 2.3 per cent by 2025, and the data suggest low level costs for grain fed beef production. The small specialist beef herd tends to have a cost exposure midway between the national average for grass and grain fed beef, with WA beef farmers being an exposed group also — particularly considering that a zero fuel cost factor has been applied in this analysis. In reality, northern beef will be subject to avgas fuel costs under the current CPM proposal.

The cash implications for annual costs and income can be substantial. Feedlot operators, whose average operating costs far exceed most broadacre farming operations, face a cost increase of around $173,098 in 2015 — even operating on a (shaky) assumption that full carbon price exemptions are in place for their

on-site fuel use. Assuming static production levels, additional operating costs due to the carbon price rise to about$355,120 per annum by 2025 (in current dollars). According to this analysis other cattle producers face annual average cost increases of between $2,425 and $6,037 per year, depending on location and speciality. For WA cattle producers, average costs due to the carbon price rise by around $9,621 per year by 2025, against a national average cost increase of $6,446 per year.

Table 4.4 BEEF cattle producer cost increases due to the CPM — assuming a full carbon price exemption for on-farm fuel use

Year	Beef – Grass (National)	Beef – Grain (National)	Beef - WA	Beef - Qld	Beef - NSW	Beef (200-400 herd)
2015	1.4%	0.8%	1.4%	1.3%	1.3%	1.2%
2020	1.5%	0.9%	1.5%	1.5%	1.4%	1.3%
2025	2.3%	1.6%	2.2%	2.3%	2.1%	2.0%
	Change to average beef farm costs (assuming current production and inputs)					
2015	$3,866	$173,098	$6,037	$5,272	$4,086	$2,425
2020	$4,369	$203,208	$6,608	$5,969	$4,537	$2,709
2025	$6,446	$355,120	$9,621	$8,843	$6,676	$4,073

Similar results are generated in the sheep meat analysis (Table 4.5), although cost exposures are slightly lower for sheep than cattle. And no special information is available on use of LPG or other non-liquid fuels that do not share the carbon price exemption under the CPM. Of the specialised lamb and mutton producers, WA producers appear to have the highest exposures. Costs to these producers rise by 1.4 per cent in 2015, and to 2.2 per cent by 2025. Mixed sheep –beef farming has a higher exposure still, with an estimated cost increase of about 1.5 per cent by 2015 under the CPM, rising to 2.3 per cent by 2025.

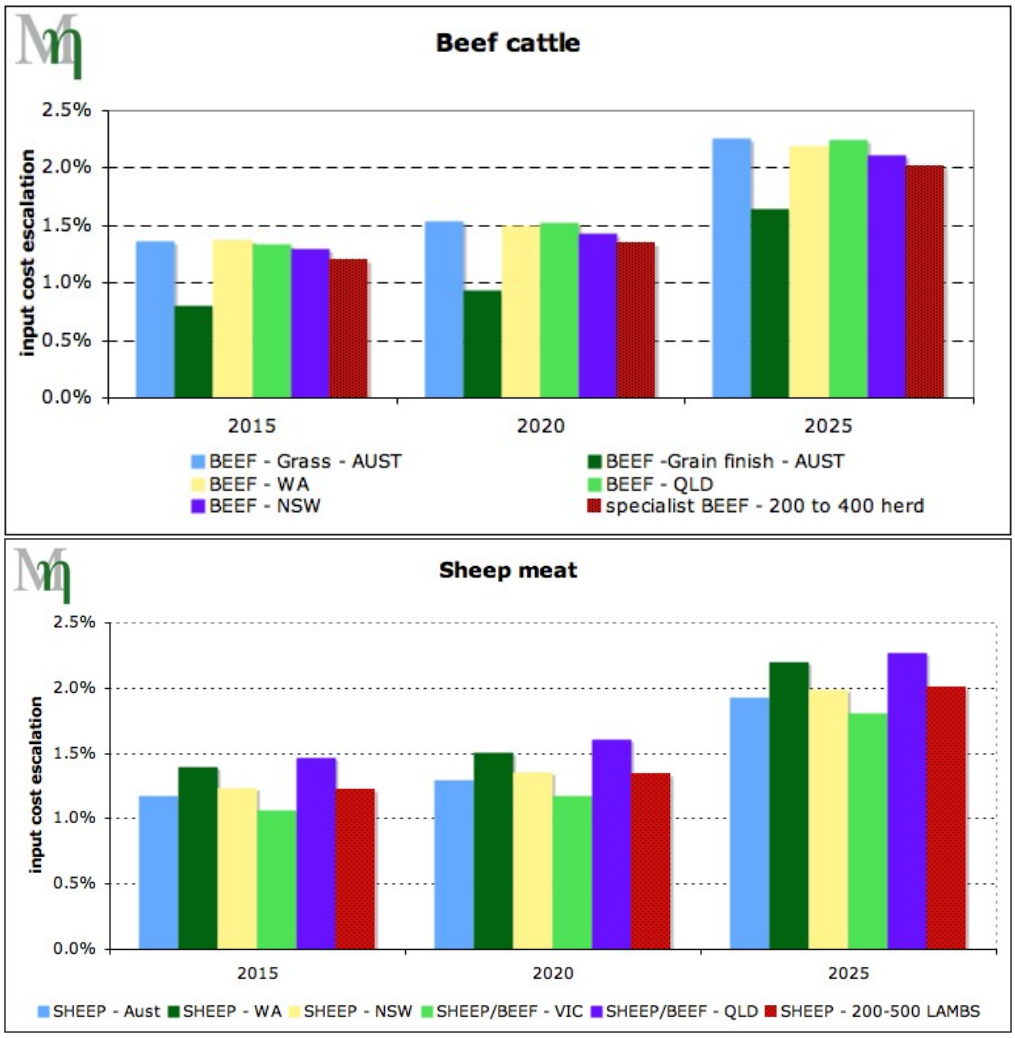
The cash cost implications amount to an increase, on average of around $2,638 a year nationally by 2015, rising to $4,313 per year (in 2010 dollars). WA sheep farmers face annual cost increases of around $12,096 per year by 2025. By comparison, Victorian sheep-beef producers bear additional costs of about $2,502 per year by 2015, and around $4,258 by 2025.

Table 4.5 SHEEP producer cost increases due to the CPM

Input	Sheep (National)	Sheep - WA	Sheep - NSW	Sheep/ beef - Vic	Sheep/ beef - Qld	Sheep (200-500 sale)
2015	1.2%	1.4%	1.2%	1.1%	1.5%	1.2%
2020	1.3%	1.5%	1.4%	1.2%	1.6%	1.3%
2025	1.9%	2.2%	2.0%	1.8%	2.3%	2.0%
	Change to average sheep farm costs (assuming current production and inputs)					
2015	$2,638	$7,673	$4,341	$2,502	$3,551	$2,889
2020	$2,900	$8,306	$4,762	$2,763	$3,910	$3,174
2025	$4,313	$12,096	$6,972	$4,258	$5,519	$4,739

These comparative impacts for beef and sheep meat are illustrated in Figure 4.1.

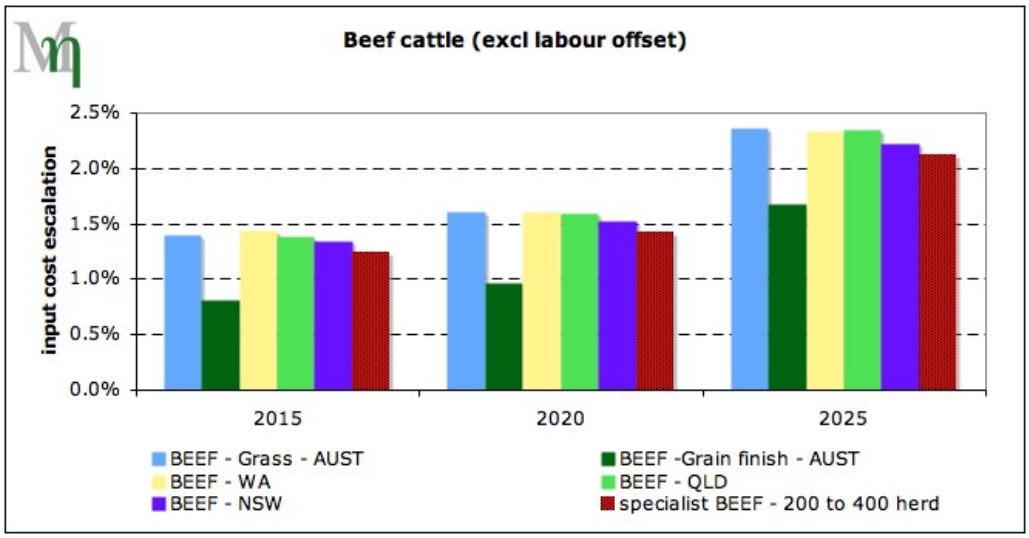
Figure 4.1 Variation in cost exposures under the CPM — Beef cattle and sheep (with full C-price exemptions for fuel)

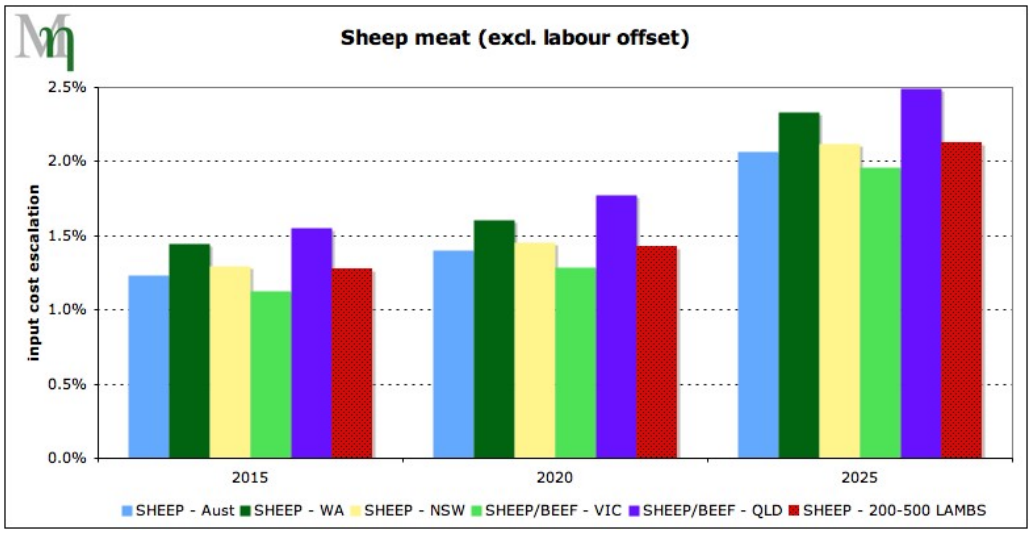


While these results are broadly in line with earlier AFI analysis of cost impacts under an animal and fuel emissions exemption scenario, they tend to reflect bigger impacts than the CGE results. A range of factors are in play, including base year differences and the use of 'frozen' production combinations in the sub-sector analysis reported here compared to dynamic substitutions in the CGE analysis which shift between inputs to give the least cost combination of inputs to produce a unit of output. These dynamic input substitutions are a cost minimisation mechanism that is not employed in static analysis.

In the analysis below we also vary the result — generated in the MMRF analysis – that real wages will decline under the CPM due to reduced growth and demand in the economy (relative to the base case), and this works a partial offset to other CPM-induced cost increases. An additional set of simulations was undertaken in which a zero decline in real wages was tested. These results appear in Figure 4.2.

Figure 4.2 Variation in cost exposures under the CPM with real wage reductions excluded (and full C-price exemptions for fuel)— Beef cattle and sheep





The impact of this adjustment is modest. The reason for this can be found in Tables 4.2 and 4.3. For the most part direct labour costs (according to AgSurf and the MLA Farm Survey) are only a modest share of total costs — typically below 9 per cent in the sheep sector, and 7 per cent in the cattle sector. And while electricity is an emission intensive input, it usually represents less than 1 per cent of costs. Freight, fodder and seed and chemicals continue to play a more significant role in producer costs, and the cost of livestock purchases (which involves very few imports).

4.3 Important and absent input data

Aggregation of data and information gaps can mask important production relationships that will be impacted by the CPM. Discussions with industry representatives highlight the use of particular inputs and processes that will be heavily affected by the proposed carbon pricing arrangements. However, further investigation reveals that consistent data on the extent of these practices at an industry level is not available in the public statistics and industry data sets. Faced with this limitation, analysis of these production practices is necessarily only indicative of the level of costs and disparities that will impact particular farm and regional activities under the CPM. Two examples of these hidden impacts are presented below.

Heli-mustering in northern beef production

A supplementary issue relates to the likely cost impacts for beef production in northern Australia. As noted earlier, northern beef has a particular reliance on aircraft for mustering, pest eradication and stock and property inspection work. And while definitive numbers on the use of helicopters and helicopter contractors are not available, the empirical evidence that is available suggests that the use of aviation fuel in conducting these businesses is significant.

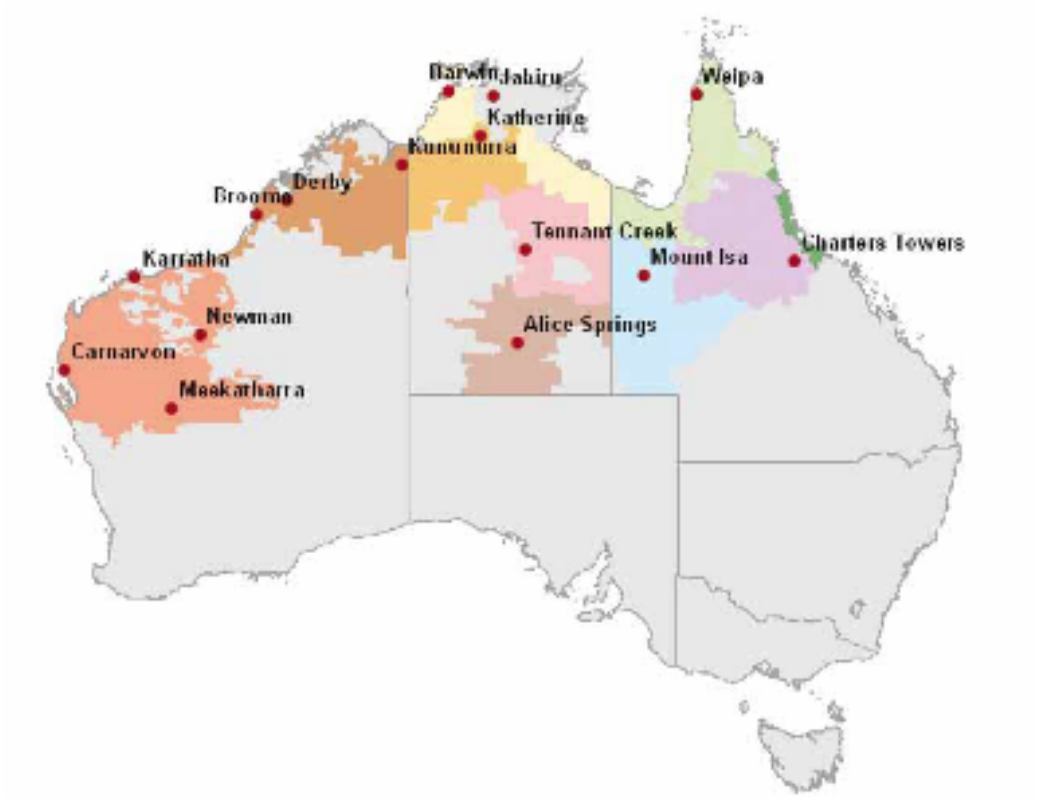
ABARES (July 2011) reports that, as at June 2011 there is an estimated 1,459 farm businesses with 100 beef cattle or more operating in the northern live cattle export region (see Figure 4.3). These accounted for around 6.7 million cattle, around 600,000 of which are intended for live export.[17]

A recent survey of mustering costs for cattle in WA, put the current cost at around $28 per head in the Pilbara and $19 per head in the West Kimberly region — mainly associated with heli-mustering across different terrain and avgas purchases. The price of avgas was reported at about $1.90 per litre for these farms.[18]

[17] See ABARES (2011), ABARES survey of beef cattle producers in northern live cattle export regions, July 2011.

[18] See ABC Rural (WA), Northern cattle stations facing an expensive year for mustering, 24 May 2011 (http://www.abc.net.au/rural/wa/content/2011/05/s3225758.htm?site=kimberley), accessed 24 September 2011.

Figure 4.3 Northern live cattle export regions



Source: ABARES (2011), ABARES survey of beef cattle producers in northern live cattle export regions, July 2011.

In a separate commentary on the industry, an April 2011 article published by Beef Central noted that contractor costs for heli-mustering (based on the popular Robinson 22 two seater helicopter) are around $260 per hour plus fuel, and fuel consumption is around 32 litres per hour for this aircraft.[19] This suggests the range of fuel cost shares shown in Table 4.6.

Table 4.6 Indicative cost share of avgas in helicopter mustering

Capital & labour cost ($ per hour)	Avgas consumption (litres per hour)	Avgas cost per hour ($) @$1.90 per litre	Avgas share of hourly operating costs
$260	32	$60.80	18.9%

This suggests that for an 'average' northern cattle station (with an average herd of 4,592 head), the cost of aviation fuel (with cost structures similar to these WA operations) is likely to be in the range of $3.60 to $5.30 per head, or $16,530 to $24,340 per farm per year.

Importantly, without a fuel exemption for avgas, the cost of mustering on these stations will go up. And this is a cost that southern farmers using bikes and trucks for their mustering operations will not be subject to. At 2.2 kg of CO2e emissions per litre of avgas (noting the reduced upstream emission liabilities

[19] See Beef Central (2011), Heli-mustering game changer, (by Jon Condon), 19 April 2011 (http://www.beefcentral.com/p/news/article/7) accessed 24 September 2011.

for refineries under the CPM's emission intensive trade exposed arrangements), this works out as an additional impost on farms in the range indicated by Table 4.7. Of course, the table does not take into account real wage changes and flow on impacts for contractor costs induced by the CPM.

Table 4.7 Production cost implications of the CPM for avgas use in heli-mustering

CPM price (per tCO2e)	Added cost per litre for Avgas ($)	Added mustering cost per head (@ $19 currently)	Added mustering cost per head (@$28 currently)	Added cost per avg farm (@$19 per head)	Added cost per avg farm (@$28 per head
$23	$0.05	$0.096	$0.141	439.15	647.17
$30	$0.07	$0.125	$0.184	572.81	844.14
$40	$0.09	$0.166	$0.245	763.74	1,125.51

These figures suggest that the carbon price will add between 9.6 and 14.1 cents per head to the cost of production to northern beef, in its first year of operation. This will rise to between 12.5 and 18.4 cents per head per year by 2020, when the expected price per tonne of CO_2 is expected to rise to about $30 per tonne. For the 'average' farm, $23 per tonne of CO_2 translates into an annual additional cost for avgas of between $$439 and $647 per year. By 2020, these costs increase to between $572 and $844 per year. These are not costs that would be borne by southern farmers using land-based vehicles for mustering, or overseas competitors servicing the South East Asian market.

Of course, many northern cattle stations are much larger than the 'average' estimate used here. A cattle station in the (more dispersed) Pilbara region with a herd of 20,000 that uses heli-mustering will face additional annual costs of about $2,820 per year in the first year of emissions pricing, and this can be expected to increase to about $3,675 by 2020 as the carbon price increases.

LPG use in feedlots

LPG is commonly used in larger feedlots as an energy source to generate steam from boilers for 'steam flaking', a feed preparation process where grain is steamed prior to being rolled to produce flakes for consumption by cattle. As discussed in chapter 3, industry sources indicate that a mid sized feedlot with a throughput capacity of about 30,000 cattle per year would be likely to spend around $320,000 to $350,000 per year on LPG (for steam generation). This size feedlot and larger, some which turn out up to 120,000 cattle per year, are reported to dominate annual output in the grain fed cattle industry. Industry sources indicate that the top 3% of feedlots in terms of size (who correspondingly are the main users of steam flaking) contribute 45% of potential industry capacity. Accordingly, whilst any increase in LPG costs will likely be disproportionately felt by these larger feedlots, it will in turn affect the wider feedlot industry's competitiveness and production capabilities as a whole given their dominance.

Table 4.8 shows likely cost increases for LPG within Australia as a result of the CPM, based on MMRF-Green output. It also indicates the likely additional costs facing large feedlots, based on an indicative current LPG cost of around $350,000 per year for a feedlot turning out 30,000 cattle a year.

The Table indicates that a mid sized feedlot using LPG to fuel its steam flaking plant is likely to see its LPG costs rise by around $33,600 a year by 2020, and by about $44,450 a year by 2025. A large feedlot with throughput of about 120,000 head per year would be facing additional LPG costs of around $120,400 per year by 2015 and $177,800 per year by 2025.

If the average additional costs calculated in Table 4.4 are assumed for a mid-sized feedlot turning out 30,000 head per year, this suggests a total annual additional cost exposure under the CPM of around $200,000 per year by 2015, and extra costs in excess of $400,000 per year by 2025.

Table 4.8 LPG cost increases facing producers under the CPM

Grain fed cattle input	*Cost increase relative to base case*			
	2015	2020	2025	2030
LPG cost increase (%)	8.6%	9.6%	12.7%	16.3%
Feedlot A: 30,000 head pa throughput: ($'000s pa)	$30.1	$33.6	$44.5	$57.1
Feedlot B: 60,000 head pa throughput: ($'000s pa)	$60.2	$67.2	$88.9	$114.1
Feedlot C: 120,000 head pa throughput: ($'000s pa)	$120.4	$134.4	$177.8	$228.2

The split out of LPG for feedlots is obviously important – though it can only be regarded as a rough estimate given that it has not been derived from a full industry survey. The magnitude of this expenditure and its contrast with the total 'fuel' cost results reported in the ABARES farm cost databases also merits further investigation. It can be extremely difficult to reconcile data drawn from different sources that use different sampling techniques. Differences in industry cost structures reported from the ABARES surveys and the ABS input-output dataset (which underpins most CGE work) are apparent.

Chapter 5

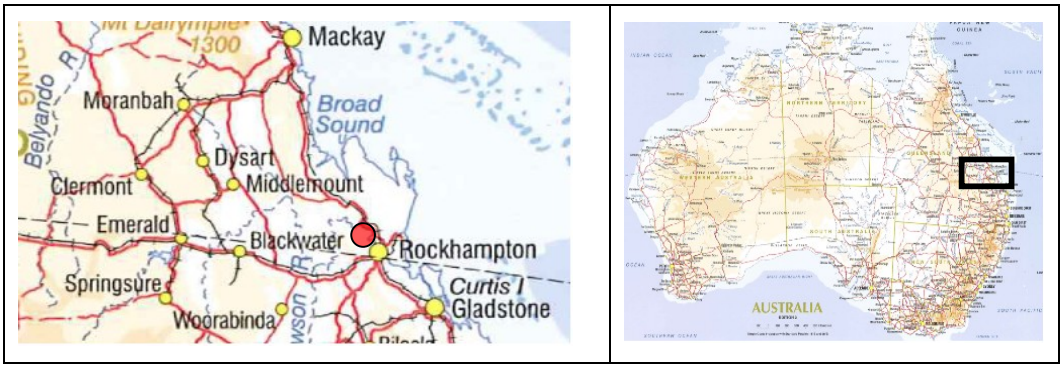
Case studies: perspectives from meat processors

A set of case studies has been assembled to complement the modeling work. These highlight actual market and production relationships that have been established in the supply and output chain, and the nature of pressures and responses likely to be generated under the new carbon pricing regime. Processors have provided information on their annual output and greenhouse gas emissions profile to facilitate this analysis. Information on Scope 1 emissions (emissions occurring on-site from fuel combustion and other production activities) and Scope 2 emissions (emissions generated off-site to produce the electricity they use) are important indicators of carbon price exposure. Importantly, the obligation threshold and CPM coverage issues discussed in Chapter 2 can have a significant bearing on the carbon price exposure of some operators - particularly via the liabilities associated with emissions from waste ponds.

5.1 Teys Australia facility, Rockhampton

Teys – Rockhampton processes grass fed beef sourced mainly from the adjacent regions. It operates Australia's largest single shift slaughter, and currently employs about 1,100 people, making it Rockhampton's largest employer. It is part of Teys Australia Pty Ltd, which operates 6 processing plants and 2 feedlots spread across Queensland, New South Wales and South Australia.

Figure 5.1 Region map — Rockhampton, Qld



Source: Geoscience Australia (GEOCAT 65186), www.ga.gov.au

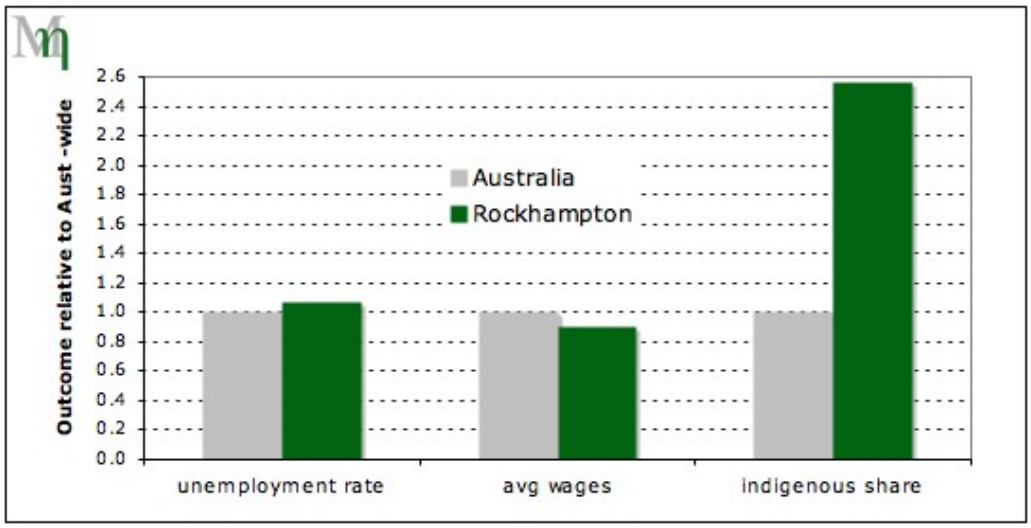
Over the 2010-11 financial year, Teys – Rockhampton processed nearly 340,000 cattle — equivalent to about 95.4 kilo tonnes HSCW. About 80 per cent of output from the Rockhampton site is shipped overseas for sale in major export markets — a significantly greater share than the current industry average.

Regional linkages and background

Teys' 1,100 strong workforce is a significant component of total employment within the Rockhampton area. The Rockhampton statistical subdivision (SSD), which stretches in a 10 kilometre wide arc extending about 40 kilometres either side of the city, has a total population of about 77,000 and 34,200 wage and salary earners (ABS Regional profiles, 2008 estimate). The City of Rockhampton itself accounts for the vast majority of these, with a total population estimated at about 65,850 (in late 2010).[20] Agriculture is the backbone of the local economy, with Rockhampton promoting itself as the 'Beef Capital of Australia'.

Figure 5.2 provides some further detail on the socio-economic characteristics of this region defined by the Rockhampton statistical subdivision, compared to Australian averages. These characteristics, based on 2007/08 data, highlight the strong indigenous component of the population (almost 2.6 times the national average), and the slightly lower wages and higher unemployment rate within the local community.

Figure 5.2 Socio-economic characteristics — Rockhampton SSD



The vulnerability of this community to economic challenges is also highlighted by ABS analysis of levels of socio-economic disadvantage and resources (see ABS 2033.0, Socio-economic indexes for Area (SEIFA), March 2008). ABS analysis for the population covered by the Rockhampton regional council suggests that this community falls in the fifth decile for social disadvantage within Australia, meaning that at least 50 per cent of regions (defined at the local government level) are wealthier than Rockhampton. The region also falls in the fifth decile for 'Education and Occupation'. It falls in the third decile for

[20] http://population-of.com/en/Australia/04/Rockhampton/

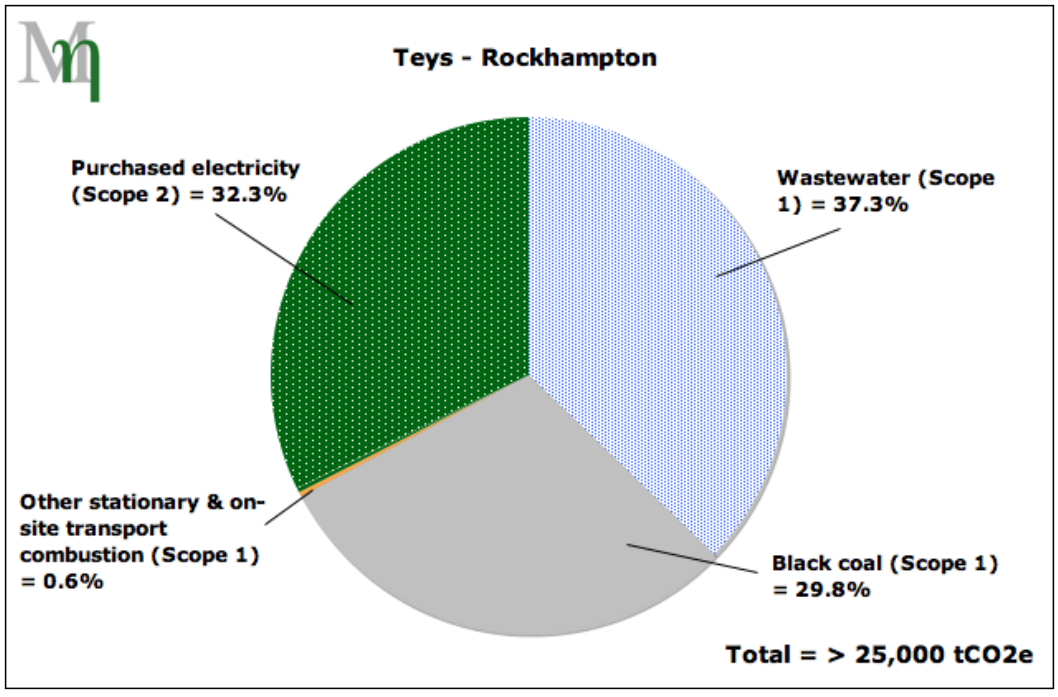
the 'Economic Resources' measure — meaning that more than 70 per cent of regions rank higher. This last measure suggests the potential fragility of the Rockhampton community to events that adversely affect its relatively narrow economic base.

Implications of carbon pricing

Teys' plant in Rockhampton has an emission profile built mainly on its direct consumption of black coal, used for firing its boilers, significant electricity purchases and emissions from on-site wastewater treatment. Figure 5.3 highlights the dominance of these activities in the plant's 2009-10 emissions profile, with wastewater emissions contributing around 37.3 per cent of that year's Scope 1 and 2 greenhouse emissions 'footprint'.

Scope 1 emissions from coal combustion and wastewater push Teys well over the CPM's 25 kilotonne emissions limit, meaning that it will be required to purchase permits for these greenhouse gas emissions. In addition to these direct liabilities, Teys – Rockhampton will also pay the carbon price on electricity and fuel purchases, the upstream suppliers of which bear (and substantially pass on) the carbon costs associated with these products.

Figure 5.3 Greenhouse profile: Teys – Rockhampton, 2009-10



Based on 2009-10 emission and production levels, at the CPM starting price of $23 per tonne, this would amount to extra costs for the facility of up to $1.7 million per year. And production data suggests that this was a lean year for the Rockhampton facility — with output levels about 15-20 per cent below normal. This suggests that even at starting price levels, the CPM could easily add about $2 million per year to the operating costs of this plant. By 2020, with its current

emissions profile, Teys – Rockhampton is facing additional costs well in excess of $3 million per year (in today's dollars) as a result of the CPM.[21]

The combination of grid-electricity, and emission liabilities for on-site black coal combustion and methane from anaerobic digestion of wastewater gives an emissions figure of about 260 kg CO_2e per head (of cattle), or 0.95 tonnes CO_2e per tHSCW. At a price of $23 per tCO_2e, this implies that the cost of processing a steer at Teys' Rockhampton plant will increase (on average) by around $6 per head.

And opportunities to substantially pass these costs on are likely to be limited. With about 80 per cent of output sold internationally, and little likelihood of other major beef exporters imposing carbon costs on their output, Teys' ability to pass these costs on to overseas customers is negligible. And competition in the domestic market, especially by abattoirs with lower per unit emission liabilities (by virtue of their production processes, or below-threshold Scope 1 emissions profile), will also be a limiting factor on cost pass through to customers.

Teys' ability to shift these costs onto suppliers will depend on the alternatives open to cattle farmers and competition in the area. Teys – Rockhampton generally negotiates to purchase its cattle at the gate, meaning that producers are responsible for the costs of delivering their stock to the Rockhampton facility. By implication, it is the farmers that will initially be faced with the need to absorb cost increases in road haulage due to rising carbon costs. Beyond this, they can be expected to direct their stock to buyers and processors prepared to pay them the highest price. For graziers in the north this can include overseas markets, and it may only take a few seasons for farmers to adjust their production in order to make this transition.

Detailed information on local supply chain and business cost structures would be required to estimate the degree to which Teys – Rockhampton may be able to 'share' its new carbon cost burden with suppliers, or be subject to additional competitive pressure from processing facilities subject to lower carbon costs.

Scope for adjustment

In the face of looming carbon costs, Teys is exploring options for reducing its emissions profile. It has little option to reduce its reliance on black coal for energy generation. It has actively explored the option of switching its boilers to natural gas, but there is not sufficient additional capacity in the local gas network to provide for Teys annual requirements. The shortfall in gas will see Teys locked into black coal until a major expansion in gas supply and pipeline infrastructure is undertaken.

Its waste ponds are also a major focus, given their significant contribution to the Rockhampton facility's greenhouse gas output. However, major investment and reconfiguration would need to be undertaken in order to reduce wastewater emission levels. As noted by Teys '… covering and flaring ponds is an expensive exercise, likely in the area of millions of dollars'.

[21] Based on an assumed cost of CO2 of $35 per tonne in 2020 (or US $33) in real terms (2010 dollar values).

A key complication with the Rockhampton configuration is that its waste ponds are 5 km from the abattoir, and covering these to collect methane for bio-energy is not a commercially viable solution. To move in the direction of bio-energy may require a whole new (and expensive) approach involving relocating the waste ponds and installing covered anaerobic digestors on site.

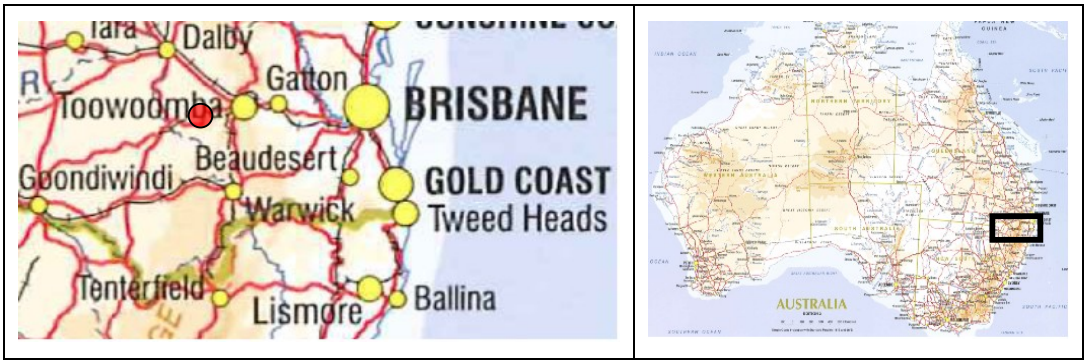
Options for improving energy efficiency are also being explored, but there are few easy solutions that offer substantial emission and energy cost reductions. And upgrading energy technologies will mean substantially higher investment costs that will need to be recouped into the future.

5.2 The Oakey abattoir, Oakey (Qld)

Oakey Abattoir is situated near Toowoomba in Queensland's Darling Downs (see Figure 5.4) and specialises in processing high quality grain-fed and grass-fed beef. The plant is a fully integrated slaughtering, fabricating, chilling, freezing and rendering facility with a capacity of up to 1,200 cattle per day, making it one of Australia's largest meat processing facilities.

The majority of its grain-fed cattle are steers sourced from Nippon Meat Packers Australia (Oakey's parent company) own integrated feedlot at Whyalla in Queensland. The grass-fed cattle are predominantly sourced from farms in the Darling Downs and other areas of Queensland. Over the last three years it has had an average throughput of around 221,000 animals per year, averaging around 327 kg per head. It is primarily an export facility, with about 70 per cent of its output sold overseas — mainly to Japan.

Figure 5.4 Region map — Toowoomba, Qld



Source: Geoscience Australia (GEOCAT 65186), www.ga.gov.au

Regional linkages and background

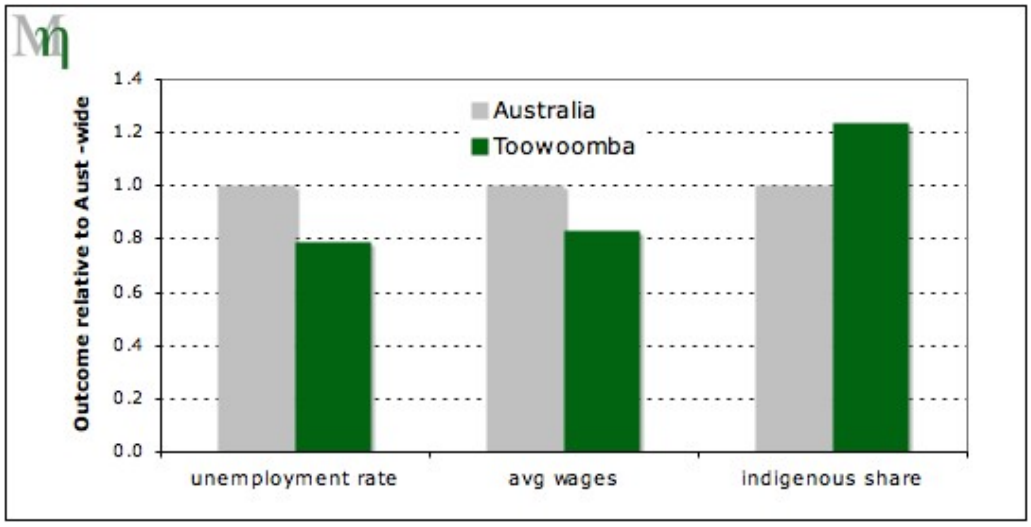
Oakey currently employs about 700 people, with more than a third of these coming from the Oakey township itself. With a population of around 4,000 this makes the abattoir Oakey's largest private employer (an army aviation centre is also located nearby) and a major source of income for the town. The regional centre of Toowoomba is about 30 minutes drive away, and is home to many of the other workers at the Oakey abattoir. Overall, the Oakey processing facility accounts for about 1.1 per cent of employment in the Toowoomba Regional

Council area, and is a key reason for the above average share of manufacturing sector employment in the region.[22]

While the community spanned by the statistical subdivision (SSD) centred around Toowoomba enjoys an unemployment rate below the national average (eg. 3.3 per cent versus 4.2 per cent in 2007), its profile also reveals a below average level of wages and salaries, and a share of indigenous residents about 20 percent above the national average. It is an urbanised inland community, with strong ongoing linkages to the rural sector and grazing activity in the Darling Downs.

The ABS Index of Relative Social Disadvantage ranks Toowoomba in the seventh decile within Australia, suggesting that about 30 per cent of communities (defined at the local government level) are on average 'wealthier' than the average Toowoomba resident. Toowoomba also score in the seventh decile on the ABS Index of Education and Occupation, but only in the fifth decile for the Index of Economic Resources. Toowoomba is a prosperous inland Australian city, with strong linkages to the resource base in the local area.

Figure 5.5 Socio-economic characteristics — Toowoomba SSD



Source: ABS Regional profiles, 2007/08

Implications of carbon pricing

Oakey's 2009-10 NGERS report indicates that its greenhouse gas emissions, inclusive of Scope 2 emissions (from off-site electricity production) were equivalent to 50,255 tonnes of CO_2. Scope 1 emissions from direct combustion of coal for boilers, mains gas and wastewater emissions contributed about 27,400 tonnes of this output (see Figure 5.6).

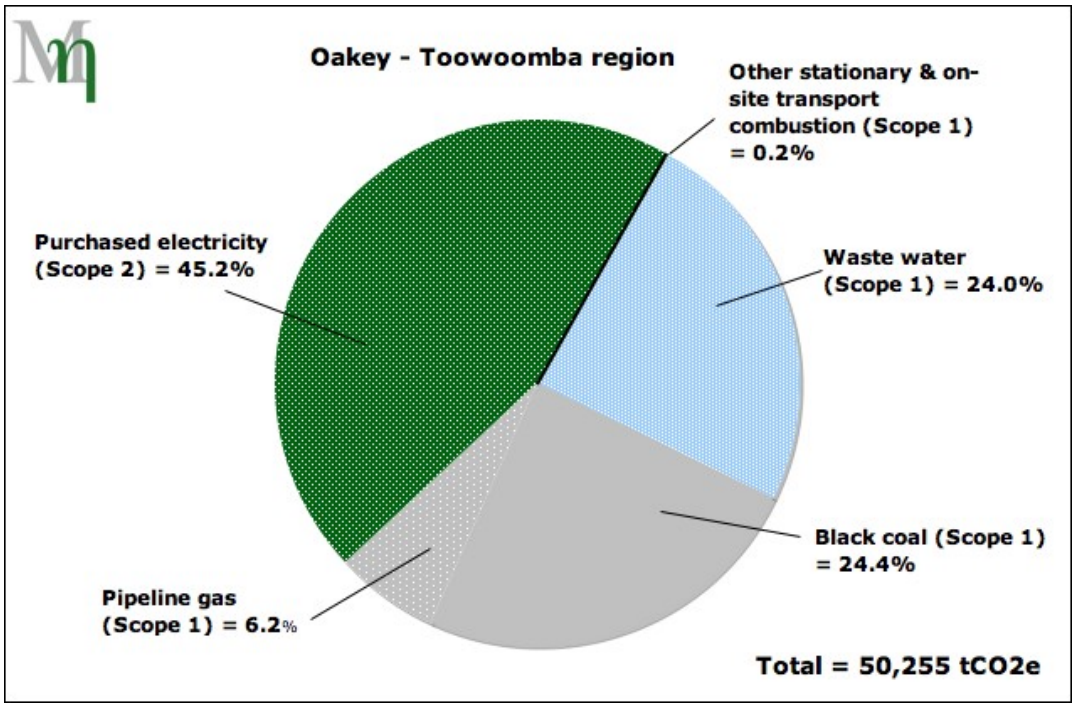
As a stand alone facility, Oakey is just over the 25,000 tonne per annum Scope 1 emission threshold and is therefore liable for all of its on-site emissions —

[22] About 11.8 per cent of jobs in the Toowoomba Regional Council area are attributable to manufacturing compared with a Queensland average of 9.9 per cent. See Queensland Regional Profiles (Toowoomba LGA 2010), Office of Economic and Statistical Research (www.oesr.qld.gov.au) 19 September 2011.

including those from wastewater. Recall that under the CPM arrangements a business or other liable emitter is only required to provide permits for direct on-site emissions from facilities that emit over 25,000 tonnes per year after deducting emissions from liquid fuels, LPG, LNG and CNG, and synthetic gas (such as refrigerants).

The carbon tax cost increase on 2010 production figures and emissions under Scopes 1 and 2 equates to a cost of about $4.60 per head for the animals processed in the abattoir in the first year of the CPM, rising to about $7.00 per head (of cattle) by 2020, valued in today's dollars (these figures equate to about $17 per tHSCW and $26 per tHSCW respectively). At a plant level, the CPM stands to add about $1.16 million to Oakey's operating costs in the first year.

Figure 5.6 Greenhouse profile: Oakey abattoir, 2009-10



These are the directly attributable costs due to the carbon price, including direct carbon liabilities and higher electricity prices due to carbon costs on electricity generators, which would be passed through to the processor. The cost per head does not include the effects of the carbon price on other intermediate goods and services suppliers that will be passed along the supply chain.

The competitive framework for the Oakey abattoir

Oakey is an export abattoir so the prices it receives are dependent upon world prices, and it has little influence on these. Prices in the domestic market will reflect competition among domestic suppliers, the availability of imports and the return that Australian producers can obtain by selling their livestock overseas.

Nearly all of the livestock delivered to Oakey are transported at the cost of the farmer. The region is a highly productive cattle area but it is a competitive market and Oakey and other abattoirs source from a variety of regions to get the specific types of cattle required for particular markets and contracts.

Scope for adjustment

Oakey management indicate that there are some very good technological developments in progress that will help them reduce their emissions. Anaerobic digestion for example is a technology which will allow energy in wastewater to be converted to gas and can be used to provide energy for heating requirements of the abattoir. This would significantly reduce one area of their emissions and therefore their carbon tax liability. Currently such solutions are not available on a commercial "off the shelf" basis and as such are heavily reliant on R&D feasibility studies etc.

Here lies the dilemma. Since the technology has not been widely adopted, the price of installation remains commercially unviable. There are concerns that the industry has few options in available technologies to reduce emissions on a commercial cost basis and the Commonwealth government's proposed subsidy to the food processing industry for new investment is not sufficient to justify investment in any currently available emission reducing technologies.

Oakey management highlight that the meat processing industry is highly competitive, and works on slim margins. Nevertheless, for its grain fed and regional cattle suppliers, live export was not a strong option and this suggested that a large share of the new carbon cost burden would be passed back to farmers. On the other hand, if exchange rate movements provided a boost to export prices this might alleviate some of this pressure, and see Oakey offering higher prices for cattle in order to increase its throughput.

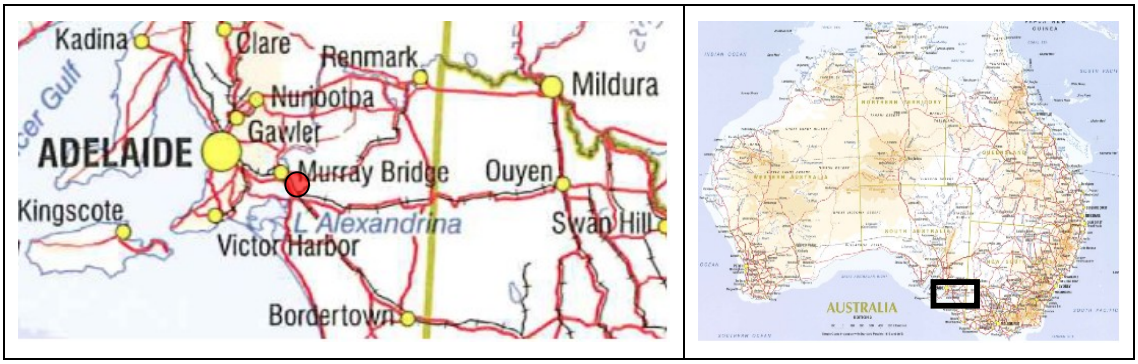
A further strategy for Oakey is to try to bring its liable Scope 1 emissions below the 25,000 tonnes per annum threshold. A reduction of around 2,500 tonnes per year would see the liability for its wastewater and coal related combustion emissions eliminated (carbon costs, but not emission permit obligations, for grid connected natural gas would still apply). Together, these two Scope 1 contributors account for about 24,000 tonnes of emissions per annum. Given that these emissions are worth around $1.8 million over the first 3 years of the scheme, this suggests a sizeable incentive for effectively shaving 5 to 6 per cent off the plant's annual emissions output.

5.3 T&R Pastoral facility, Murray Bridge (SA)

T&R's processing facility at Murray Bridge is a large multi-species plant, with a capacity to process up to 800 cattle and 9,000 sheep per day. In 2010, it produced over 42,800 tonnes of beef and 44,200 tonnes of sheep meat for market, about 80 per cent of which was sold overseas. It has a strong export focus, with US and EU accreditation and a Halal slaughter line.

The Murray Bridge operation is one of Australia's largest, currently employing around 1,200 people in the local area and making it the key source of manufacturing sector employment in the region. It provides about twice as many jobs as the next biggest employer in the area.

Figure 5.7 Region map — Murray Bridge, SA

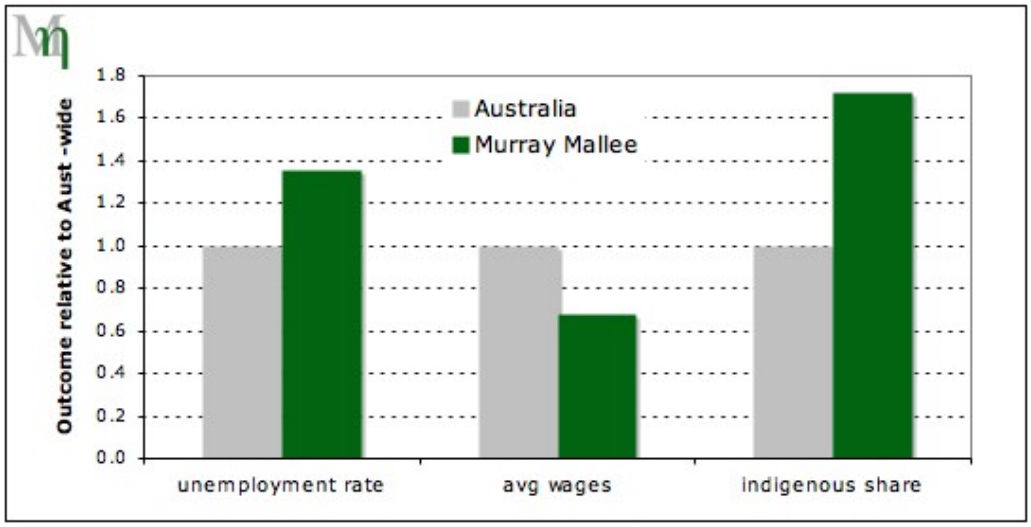


Source: Geoscience Australia (GEOCAT 65186), www.ga.gov.au

Regional linkages and background

Murray Bridge is a rural city with a population of about 18,000, and is the major centre in the Murray – Mallee statistical subdivision (SSD). Located close to the outlet of the Murray River it has a strong agricultural base, and is at the southern end of the Murray-Darling Basin.

Figure 5.8 Socio-economic characteristics — Murray-Mallee SSD



Source: ABS Regional profiles, 2007/08

ABS data reported in Figure 5.8 indicate that the Murray-Mallee SSD, which is the principal source of labour for the T&R Murray Bridge plant, has a significantly higher unemployment rate than the national average, and an average wage rate that is 30 per cent below the national average. Its profile for 2007/08 also indicates a strong indigenous presence in the area, with 4.3 per cent of the population being first Australians compared to 2.5 per cent Australia-wide.

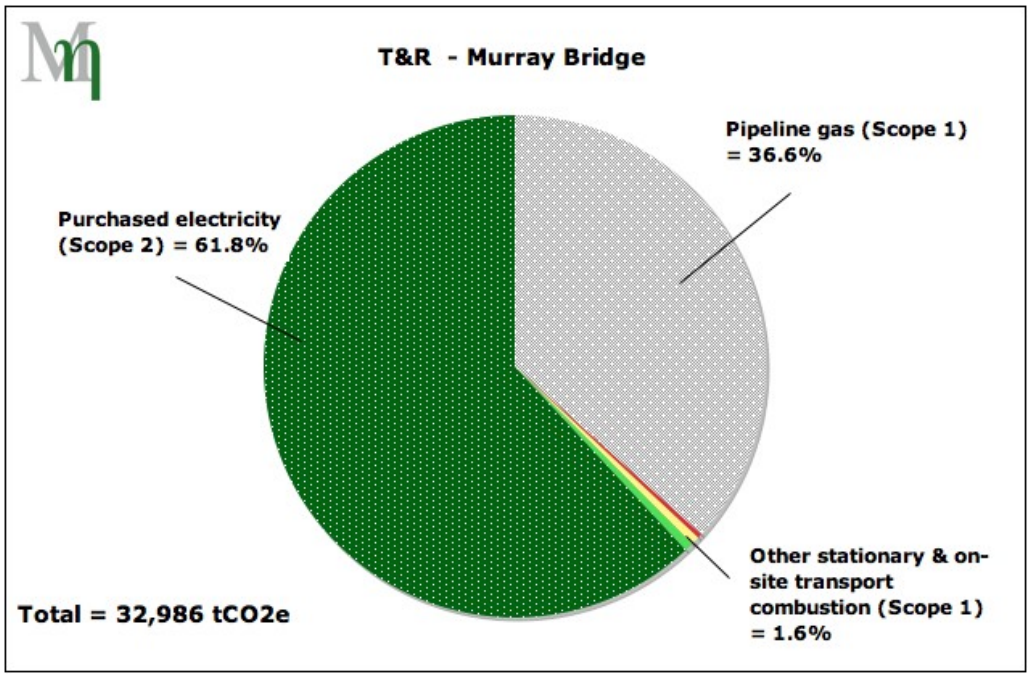
Analysis of socio-economic data also suggests significant disadvantage within the community. The ABS index of relative socio-economic disadvantage places the households covered by the rural city of Murray Bridge in the second decile within Australia. That is, in the poorest 10 to 20 per cent of communities. It is also ranked in this decile on the ABS 'index of economic resources' and in the

bottom 10 per cent of rankings for the 'index of education and occupation'. It is likely to be a community that is vulnerable to economic dislocations and downturns, and strongly dependent on established local employers and occupations.

Implications of carbon pricing

The T&R Pastoral meat processing plant at Murray Bridge has a modest greenhouse footprint for its level of output. In 2009-10, it produced 32,986 tonnes of CO_2e emissions, for just over 87,000 tonnes of output. As shown in Figure 5.9, its principal emission sources are mains gas (Scope 1) and electricity (Scope 2). Together these sources account for over 98 per cent of the emissions of T&R's Murray Bridge plant. The absence of emissions from wastewater is also a noticeable feature, and at present, annual Scope 1 emissions from the plant are less than 13,000 tonnes per year. This means that Murray Bridge will not have an obligation to surrender emission permits under the government's carbon pricing mechanism.

Figure 5.9 Greenhouse profile: T&R — Murray Bridge, 2009-10



Extensive use of gas as the primary combustion energy source has clearly contributed to T&R's low emission profile. And the absence of wastewater emissions is due to the fact that the Murray Bridge plant does not operate anaerobic ponds to treat its effluent. Instead T&R puts it through an active primary treatment process and then directs it to irrigate nearby farmlands. However, this treatment process is relatively energy intensive, and costly. T&R also recognise that it can lead to undesirable nutrient build up over the longer term.

T&R – Murray Bridge's emission profile currently works out to about 380 kg CO_2e per tHSCW. Given the mixed species nature of the abattoir, it is difficult to reliably allocate this on a per head basis between cattle and sheep. However rough figuring suggests that these emission characteristics, priced at the $23

starting price for the CPM will add about $2.36 to the cost of processing a steer in the Murray Bridge plant, and about $0.21 to the cost of processing a sheep. By 2020, when a CO_2e cost of about $35 per tonne is envisaged, the added costs per head will be around $3.60 and $0.32 per head respectively.

Of course, economies of scale are likely to be important to plant operations and these 'averages' can be misleading in terms of the emission levels that are likely to result from increased throughput, or a shift in the mix between sheep and cattle. Fixed costs are an important part of the bottom line, and the plant is highly reliant on a healthy level of throughput to keep its average costs down. This enhances the bargaining position of graziers in striking a price with Murray Bridge. The abattoir frequently draws on stock grown locally and from regions in northern NSW, WA and the NT. Seasonality and underlying supply conditions also impact on Murray Bridge's ability to protect its operating margins by passing its cost increases upstream to suppliers in the form of lower prices per head.

For the plant as a whole, a $23 per tonne carbon price can be expected to add about $759,000 per year to the operating costs of T&R — Murray Bridge. Importantly, these costs will arise in higher electricity and gas charges. Murray Bridge has no obligation to buy permits for its on-site combustion of natural gas and other fossil fuels, but will see the impact of the carbon price as it is applied upstream. The opportunity to pass these costs on to customers is also limited, given that 80 per cent of its output is focused on export markets.

Scope for adjustment

Although T&R – Murray Bridge is below the emission obligation threshold, it cannot afford to be complacent about the prospect of rising energy costs under the carbon price. Cost increases upwards of $750,000 per year are a strong motivation for seeking less emission intensive production practices. At present, T&R are proceeding with a plan to divert their wastewater to generate bio-energy. They are in the process of building a covered anaerobic lagoon that will be used to produce methane that will be substituted for pipeline gas used on site, and to displace purchased electricity. This is a multi-million dollar exercise, that will help, but not fully, offset the energy cost implications of the carbon price.

5.4 Conclusions

The case studies highlight the diversity of arrangements that are in place and being contemplated in order to deal with the increased cost pressures that the CPM will bring. For the three processors surveyed, carbon pricing will present a serious challenge to cost structures and future strategies. Over the next decade, these facilities face additional costs of between $750,000 to $3 million per year as a result of the need to pay for the greenhouse gas emissions released as a result of their waste and energy use.

The 25,000 tonne per annum emission threshold can hold the key to a major reduction in emission liabilities for some facilities. Achieving emissions below this threshold will automatically eliminate the need to pay for emissions from wastewater and coal combustion. Nevertheless, even for facilities with

emissions below the threshold, the spectre of higher energy costs is inducing a strong focus on opportunities to harness their waste stream for bio-energy production. All case study facilities are looking deeply at covered anaerobic ponds and biogas capture and flaring technologies. However, the economics stack up better for some than others.

There is little to indicate the degree to which processors can simply pass their costs onto customers or suppliers. The red meat industry is highly export oriented, and scope to push higher costs into overseas markets is clearly limited. The need for cost absorption is also likely to be underpinned by the enhanced competitive position of below-threshold operations and the ability of farmers in certain markets to switch supply between processing facilities, or ship their stock interstate or overseas to obtain a higher price.

Chapter 6

Conclusions

Analysis undertaken as part of this study – including detailed computable general equilibrium (CGE) modeling analysis using MMRF, the same domestic model used by Treasury – suggests the following broad pattern of impacts and issues.

6.1 Industry implications of carbon pricing

Key observations from this analysis of the proposed carbon pricing mechanism (CPM) are:

1. **Detailed modeling of CPM impacts on the red meat sector suggest less beneficial outcomes than Treasury has reported, and there will be significant residual pressure on some participants and regions**

Direct emission and fuel exemptions significantly reduce the cost burden of carbon pricing on cattle and sheep meat producers. However, some cost increases still flow down the supply chain via electricity and material inputs. For red meat processors, energy costs bear the full impact of the carbon price and wastewater methane emissions from larger facilities become subject to emission costs. Both producers and processors are significant users of heavy road freight, and are subject to carbon cost increases in this area. In addition, under current settings, producers who use aviation fuel will not benefit from the liquid fuel exemption in this area. For the northern beef industry, which uses helicopters and contract aviation services extensively for mustering and pest eradication work, this can amount to a significant additional cost on the industry.

Processors and producers are constrained in their ability to pass on these cost increases, because they are largely price takers in an international market. Yet modeling undertaken in this study (in line with Treasury modeling which applies both an international and domestic model) suggests output and export growth for grain-finished beef, live sheep and processed meat. Why?

The key reason is a predicted lowering of the Australian dollar under a carbon price (compared to the base case). This tends to make our products cheaper for foreign buyers, and for a range of low emission or emission exempt activities, can counter-act carbon cost increases. But for the red meat activities examined it is a line call, and modest expansionary impacts suggested by economy-wide modeling could easily be confounded by the aggregation errors and assumptions that are an accepted part of input-output modeling exercises using industry data. Although, the modeling assumes upstream costs (borne by processors) will not flow backwards along the supply chain to farmers, on the ground experience suggests otherwise. While this dynamic may be difficult to build into the structure of the model, it may nevertheless be relevant in a real world context.

For 2015, the MMRF modeling undertaken in this exercise suggests slight growth in output across grain fed beef, sheep meat and red meat processing of between 0.0 and 0.1 per cent. Against this, the modeling suggestions a contraction in grass fed cattle exports of 0.1 per cent. And for broad acre grazing, the modeling does not take account of the additional imposts associated with full carbon cost exposures via impositions on aviation fuel.

These numbers contrast with Treasury modeling results, which suggest that the CPM will have a stronger stimulatory effect on the red meat industry. Part of this may due to differing assumptions around the pattern and level of abatement action taken by countries offshore. But this effect is also likely to be due to differences in the data used. This study highlights the differences in input and production patterns across Australia, and the variations that can be found as we apply the detailed industry survey results reported in AgSurf and the MLA Farm Survey.

2. **Cattle producers and processors have a higher exposure to the carbon price, though regional characteristics can be important — particularly in the North**

Beef producers and red meat processors face higher cost increases and adverse competitiveness impacts from the carbon price. Road transport and electricity are used more intensively by these activities and are a key input. Grass fed beef is also a significant chemical user, and larger feedlots are commonly significant users of LPG — which, unlike on-farm use of liquid fuel, does not benefit from an exemption from the carbon price. The cost of these inputs rise under the influence of the CPM, through its impact on labour costs and the lower exchange rate that it induces. Sheep meat has similar dependencies, but is more labour intensive (in terms of the wage share of total production costs), and real wage reductions act as stronger buffer for this segment of the industry. For red meat processors, the modeling suggests a fall in the gross operating surplus brought about by increased costs and an inability to pass these through to consumers. Some producers have more capacity to resist cost pass through from processors than others. Northern producers are squeezed by greater orientation toward export markets (which are not subject to carbon related costs), bigger transport costs and emission charges on their use of aviation fuel.

Continuation of the fuel rebate for heavy road transport can also be important to the continued viability of some producers and processors, and is likely to have little adverse impact at a macro scale.

3. **Extending the exemption for fuel used in heavy road transport significantly alleviates residual cost pressures on the supply chain, and exempting Avgas use by farmers and farm contractors from the carbon price can remove distortions that disadvantage northern beef producers (and other agricultural users of aerial services)**

Road transport is a key input to the red meat industry, and costs imposed on it can affect the bottom line of producers. The case study, and advice from producers, highlights the close inter-dependence of farm, freight and processing facility in the red meat industry.

The modeling, and farm and processing facility-based analysis shows that there can be significant variation in the production relationships and operating margins for producers according to size, species and location. Data analysis suggests that these exposures can vary by as much as 20 per cent on a regional basis — and greater

diversity is likely across individual operations. This variation highlights the adjustment pressures that are likely to be felt by farmers and facility operators who differ from the industry 'average'. Pressure on margins, as processors struggle to pass on extra costs from the CPM is apparent. Contrary to the CGE modeling results, it is likely that a large share of these costs will find their way to cattle and sheep producers, and profit margins will be adversely affected as a result.

Extension of the emissions exemption for heavy road freight is likely to be an effective means of insulating the very narrow processor margins that characterise the Australian red meat industry. The modeling suggests that such a move — under consideration by the Multi-Party Climate Change Committee — helps reduce the adverse impact on gross operating surplus within the industry. Taken as a whole, while the CPM has a negative net impact on gross operating surplus for the industry, extension of the heavy freight carbon charge exemption produces an essentially neutral net impact.

Moreover, modeling suggests that extension of the road transport exemption will help to directly alleviate adverse impacts on production and exports indicated for grass fed cattle producers. Northern cattle producers are likely to be particularly vulnerable to the current design for the CPM, which imposes full costs on all aviation fuel users, as outlined above.

This not only adds to the costs falling on farmers in Western Australia, Queensland and the Northern Territory, but also has a differential effect on production methods within the cattle industry. Northern producers who are more reliant on aerial services as an input to their operations will be disadvantaged relative to southern producers whose mustering and pest control operations can be serviced by land-based vehicles.

Disparate treatment of on-farm vehicle fuel and on-farm aviation fuel use can shift competitive advantage south, and penalise efficient northern operators whose choice between heli-mustering and using bikes or trucks should not be pushed in a particular direction by the different tax treatment of two fuel alternatives with essentially the same greenhouse emissions signature. There is clearly a case for extending the on-farm fuel carbon cost exemption to aviation fuel used directly by farmers and contractors delivering on-farm services. Users of aerial services in the crops sector will also benefit from such a reform.

On processors

The case studies serve to highlight the range of issues and strategies that are addressed by processors, who face significant costs pressures under the CPM. Multi-million dollar cost increases are in prospect, and energy efficiency and bio-fuel initiatives are being considered. While there will be opportunities to pass on some of these costs to customers and suppliers, this opportunity is by no means expansive or universal.

The strong export orientation of processors means that their costs are not geared to servicing the domestic market alone, and large scale operations can face competition from smaller domestic suppliers with lower emission profiles and liabilities. How this will play out, requires a more comprehensive analysis of Australian processors than has been possible on the basis of information available for the current study.

Appendix 1

Architecture of the CPM and CPRS

Design element	2011 Carbon Pricing Mechanism	2009 CPRS settings
2020 target	At least 5% below 2000 emissions	5% below 2000 emissions
2050 target	-80% (2000)	-60% (2000)
Activity coverage	Exclusions: Ag, legacy waste, light vehicle fuel (**permanent omission**), refrigerants	Exclusions: Ag, legacy waste, light vehicle fuel (**for 3 yrs**), refrigerants
Gas coverage	Kyoto gases — minus SF_6 and HFCs (note HFCs are subject to a defacto carbon price via an alternative mirror mechanism) Fossil fuels subject to excise arrangements will also be subject to a mirror carbon price via those arrangements, rather than through the CPM per se.	Kyoto gases = CO2, CH4, N2O, SF6, PFCs, HFCs All fossil fuels covered by a combination of upstream, threshold and obligation transfer arrangements.
Start date	1 July 2012	1 July 2011
Start price	$23.00 from 1 July 2012, rising at 5% pa nominal until 1 July 2015	$10.00
Floating price begins	1 July 2015	1 July 2012
Max price (flexible period)	Expected international price **plus** $20 from 1 July 2015, rising at 5% pa real. Expires 30 June 2019	$40 from 1 July 2012, rising at 5% real. Expires 30 June 2017
Min price	$15.00 from 1 July 2015, rising at 4% pa real. Expires 30 June 2019	$0
International linkage **(recognition of Kyoto permits for compliance)**	Applies from 1 July 2015. Can only by used to offset a maximum of 50% of annual emission liability. Restriction lifted from 2020-21.	Import of allowances from 2015, export subject to review
Banking & borrowing	No banking of fixed price permits. Unlimited banking in flexible period. Borrowing of up to 5% of an emission liability using next year's allowances is permitted.	SAME
IETE rates & eligibility	High intensity: 94.5% rebate Moderate intensity: 66% rebate (declining at 1.3% pa)	SAME
Transport fuel treatment	Heavy vehicle fuel excise offset to negate C- cost for 2 yrs only, no C-price on fuel for light vehicles (nb. Trucks policy proposed by govt, not agreed by Multi Party Cttee)	Heavy vehicle excise offset to C-costs – review after 1 yr, light vehicles offset – review after 3 years

Design element	2011 Carbon Pricing Mechanism	2009 CPRS settings
Carbon Farming Initiative **(Australian Carbon Credit Units - ACCUs)**	Linked to mandatory system and international mkt. Unrestricted export. ACCUs can count toward **up to 5%** of domestic obligations from 1 July 2012 to 30 June 2016, unrestricted thereafter.	Undeveloped
Obligation threshold	25 Kt CO2e pa of Scope 1 emissions covered explicitly by the CPM – see above	25 Kt CO2e pa of Scope 1 emissions
Support programs (including) —	Clean Energy Finance Corporation ($10b loan fund) Australian Renewable Energy Agency (ARENA) ($3.2b) Carbon Farming Futures ($429m) CFI non-Kyoto purchases ($250m) Clean Technology Program ($1.2b) — including $150m earmarked for food sector energy efficiency improvement (1:3 matching fund), Biodiversity Fund ($946m) Steel sector adjustment program ($150m) 2000 MW high emission electricity capacity 'buy and close' scheme	Various

Appendix 2

Farm and facility characteristics

Domestic animal production – key input shares, 2009-10

Input	2005-06 input-output: BEEF	Beef Cattle	Cattle — grain finish	Sheep meat
% of input costs (Avg 5 yrs to 2009-10) - Agsurf				
Electricity	0.8%	0.8%	0.2%	1.1%
Fuel oil	0.1%	5.8	0.6	7.0
LPG/ natural gas	-	na	na	na
Chemicals & fertiliser	4.3%	3.9	0.2	13.3
Petroleum	2.1%	na	na	na
Road transport	4.7%	3.4	0.7	2.7
Aviation fuel (heli-mustering)	(incl in petroleum) AND in aviation services	Nthn cattle (some info in aviation services data)	0	na
Labour	31.2%	4.6+0.1+0.2= 4.9%	2.4+0+0= 2.4%	2.7+4.7+0.5= 7.9%
Animal purchases		17.6	66.9	12.3
Interest charges		9.5	0.9	10.1
Professional services ……		0.9+0.1+0.4+0.2= 1.6%	0.1+0.1+0.1+0= 0.3%	1.2+0.2+0.3+0.2= 1.9
Fodder …….		7.1	20.0	4.3
Industry costs $m (avg 5 yrs to 2009-10)				
Electricity		45.1m	1.6m	25.5m
Petrol and other fuels		324.6m	5.9m	167.0m
Chemicals & fertiliser		217.6m	2.24m	318.8m
Fodder		396.5m	195.4m	102.4m
Freight		188.7m	7.0m	64.6m
Labour and Ag services		368.7m	26.2m	235.9m
TOTAL of ALL INPUT COSTS		5,214.9m	975.9m	2,278.4m

Meat processing – key input shares, 2009-10

<table>
<tr><th>Input</th><th colspan="4">2005-06 input-output: Meat & meat processing</th></tr>
<tr><td colspan="5">% of input costs (2009-10)</td></tr>
<tr><td>Electricity</td><td>0.7</td><td></td><td></td><td></td></tr>
<tr><td>Fuel oil</td><td>0.1</td><td></td><td></td><td></td></tr>
<tr><td>LPG/ natural gas</td><td>0.1</td><td></td><td></td><td></td></tr>
<tr><td>Chemicals</td><td>0.1</td><td colspan="3" rowspan="4">Apply input data contained in MMRF (which depicts ‘meat & meat processing’ sector (82% of production is red meat, and 95% of exports)</td></tr>
<tr><td>Petroleum & coal products</td><td>0.1</td></tr>
<tr><td>Road transport</td><td>6.8</td></tr>
<tr><td>Labour</td><td>15.9</td></tr>
<tr><td>Other major inputs</td><td>Other services = 5.6%
Sheep = 7.1%
Beef = 39.3%
Poultry = 5.7%
Pigs = 3.0%</td><td></td><td></td><td></td></tr>
</table>

Domestic industry profile, 2009-10

Characteristic	Meat processing	Cattle – grass fed	Cattle — feedlot beef	Sheep meat
2009-10 production (red meat: based on Feb09-Feb11 avg tonnage) ABS 7218.0)				
Value production ($m)	16400	7600		2900
Value exports ($m)	5450	701		298
Share of production — NSW (%)	22.2	All beef 21% (feedlot 30%)		21%
Share of production — Qld (%)	36.8	All beef 42% (feedlot 57%)		2%
Share of production — Vic (%)	21.7	All beef 18% (feedlot 7%)		38%
Share of production — WA (%)	7.5	All beef 7% (feedlot 3.5%)		21%
Share of production — NT (%)	0	All beef 5% (feedlot 0%)		-
Share of production — SA (%)	9.6	All beef 4% (feedlot 2.5%)		16%
Share of production — Tas (%)	2.2	All beef 3% (feedlot 0%)		2%
2009 GHG emissions Kt (CSIRO & DCCEE sources, AMPC environmental sustainability review 2010)				
No. of supplying farms/facilities	130	22650	-	11640
Total Scope 1 (direct) emissions (Kt CO_2e) (eg. fuel burning, enteric fermentation, manure/ waste decomposition, refrigerant release)	247 kg CO_2e/tHSCW x 3054323 (tonnes) = 755 Kt CO2e	=35846 (animal)	-	13547 (animal)
Fossil fuel emissions share of Scope 1 total (%)	62%	As per model	As per model	As per model
Livestock and manure emissions share of Scope 1 total (%)	0	As per model	As per model	As per model
Wastewater emissions share of Scope 1 total (%)	38%	0%	0%	0%
Wastewater emissions (Kt CO_2e)	284 Kt	-	-	-

Nb. GHG Inventory number for ALL industrial wastewater emissions is about 950 Kt CO_2e, and suggests 'meat & poultry' produce about 1/3rd of wastewater output

Appendix 3

Detailed impacts of the CPM on the red meat sector

Table A3.1 Impact on annual production relative to base case

Year	Grain fed cattle	Grass fed cattle	Sheep prodn	Red meat processing
	Change from base case value (2010 $m)			
2010	0.0	0.0	0.0	0.0
2011	0.0	0.0	0.0	0.0
2012	4.6	-14.7	6.3	-16.8
2013	6.2	-12.1	10.1	-3.5
2014	7.4	-13.4	11.8	-9.3
2015	7.0	-17.9	13.3	1.8
2016	9.5	-16.9	17.5	5.7
2017	12.1	-18.5	21.8	19.7
2018	14.8	-18.8	27.3	42.8
2019	18.2	-20.6	34.2	66.6
2020	22.2	-26.5	40.9	78.4
2021	26.4	-27.6	52.3	151.9
2022	31.3	-30.4	65.1	229.8
2023	37.2	-28.7	83.5	400.3
2024	43.4	-16.5	110.7	681.7
2025	51.8	3.8	146.3	1084.3
2026	61.9	35.6	192.6	1641.0
2027	74.5	79.3	250.7	2393.1
2028	90.7	126.8	317.5	3253.9
2029	110.7	164.3	382.5	4118.8
2030	126.0	150.6	469.5	4935.3

Source: MMRF –Green modeling

Table A3.2 Impact on employment levels relative to base case

Year	Grain fed cattle	Grass fed cattle	Sheep prodn	Red meat processing
	Change from base case value ('000 employees)			
2010	0.0	0.0	0.0	0.0
2011	0.0	0.0	0.0	0.0
2012	0.0	0.0	0.0	0.0
2013	0.0	0.1	0.1	0.0
2014	0.0	0.1	0.1	0.0
2015	0.1	0.1	0.1	0.0
2016	0.1	0.2	0.1	0.0
2017	0.1	0.2	0.1	0.0
2018	0.1	0.2	0.2	0.0
2019	0.1	0.3	0.2	0.0
2020	0.1	0.3	0.2	0.0
2021	0.1	0.3	0.2	0.1
2022	0.1	0.3	0.2	0.1
2023	0.1	0.4	0.3	0.1
2024	0.2	0.5	0.3	0.2
2025	0.2	0.7	0.4	0.3
2026	0.2	0.8	0.5	0.4
2027	0.3	1.0	0.6	0.6
2028	0.3	1.2	0.7	0.7
2029	0.4	1.3	0.8	0.8
2030	0.4	1.5	0.9	0.9

Source: MMRF –Green modeling

Table A3.3 Impact on value of exports relative to base case

Year	Grain fed cattle	Grass fed cattle	Sheep prodn	Red meat processing
	Change from base case value (2010 $m)			
2010	–	0.0	0.0	0.0
2011	–	0.0	0.0	0.0
2012	–	-10.4	5.2	7.8
2013	–	-9.3	7.3	40.9
2014	–	-6.9	10.0	74.9
2015	–	-8.5	12.0	135.7
2016	–	-7.3	15.1	176.0
2017	–	-9.8	17.5	211.1
2018	–	-10.2	21.2	282.0
2019	–	-13.2	25.2	354.4
2020	–	-19.3	29.2	413.3
2021	–	-25.0	34.9	561.3
2022	–	-31.4	41.8	741.3
2023	–	-42.2	48.8	1013.6
2024	–	-52.3	58.3	1472.6
2025	–	-67.9	68.0	2062.3
2026	–	-87.9	78.8	2854.4
2027	–	-115.5	89.9	3873.0
2028	–	-150.3	102.5	5050.6
2029	–	-180.0	119.4	6347.7
2030	–	-246.3	154.3	7653.6

Source: MMRF –Green modeling

Table A3.4 Impact on Gross Operating Surplus relative to base case

Year	Grain fed cattle	Grass fed cattle	Sheep prodn	Red meat processing
	Change from base case value (2010 $m)			
2010	0.0	0.0	0.0	0.0
2011	0.0	0.0	0.0	0.0
2012	0.7	-0.1	1.2	-1.7
2013	2.1	4.6	4.7	-2.9
2014	2.4	5.5	9.0	-6.6
2015	3.0	7.7	17.1	-9.5
2016	4.1	10.7	22.9	-12.4
2017	4.3	10.3	28.0	-13.6
2018	5.8	14.8	37.8	-15.0
2019	7.1	18.1	47.4	-16.4
2020	7.3	16.1	54.7	-18.5
2021	10.6	26.3	73.5	-17.6
2022	14.2	37.1	95.6	-18.6
2023	19.8	55.6	128.3	-17.3
2024	31.3	98.0	182.5	-17.7
2025	44.9	149.5	249.5	-14.5
2026	63.0	219.8	337.0	-9.3
2027	84.9	306.8	445.7	-3.8
2028	109.1	402.3	565.9	0.0
2029	131.9	489.3	691.9	0.1
2030	160.8	592.3	884.3	-12.5

Source: MMRF –Green modeling