AUSTRALIAN MEAT PROCESSOR CORPORATION

Environmental Performance Review: Red Meat Processing Sector 2015

FINAL REPORT

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1.0 Executive Summary

This report continues a series of environmental performance reviews of the red meat processing industry undertaken by AMPC and MLA, and presents results for the 2013/2014 financial year. The methods used are broadly comparable with previous studies, but also included steps to adjust for variation in animal mix and processes undertaken (i.e. whether rendering was conducted). As such, not all results are directly comparable with those reported in previous studies.

Overall, the red meat processing industry has achieved gains in all of the six key areas of environmental concern. Highlights include:

- A modest further improvement in water use efficiency, with average industry performance reaching 8.6 kL/t HSCW (cattle equivalents)
- A 27% improvement in energy use efficiency since the 2008/2009 survey, with an average industry performance of 3005 MJ/t HSCW
- A 22% improvement in GHG emissions intensity since the 2008/2009 survey, with average industry performance of 432 kg CO_2e/t HSCW
- Almost a halving of solid waste sent to landfill since 2008/2009, with average industry performance of 5.9 kg/t HSCW

In 2012, as part of the red meat processing industry climate change strategy, goals were set to reduce water consumption per t HSCW by 10%, energy consumption per t HSCW by 10% and GHG emissions per t HSCW by 20% by 2015. Comparing the results for 2008/2009 and 2013/2014, the industry has achieved the energy use efficiency and GHG emissions intensity goals, and is part way toward achieving the water use efficiency goal.

For some indicators, sites with an environmental improvement target achieved better results. This suggests that target setting can be a beneficial activity and an important first step that leads to the identification and implementation of environmental improvement measures at the local level.

While industry-wide environmental performance improvement has been achieved, large variations were also reported between individual sites, suggesting there remains scope for substantial further improvement.

A key recommendation is for the industry to adopt a standard protocol for environmental data management and reporting which will improve the quality and reduce the cost of future environmental performance reviews.

The author should include in the Executive Summary an overview of the project objectives, approach, project outcomes and insights, conclusions and recommendations for further research/actions. This section should also include the project results and findings that can benefit members and the wider industry. This section should be a maximum of two or three A4 pages.

2.0 Introduction

2.1 Background

The red meat processing industry is an important rural industry in Australia, being the largest food manufacturing sector as well as the largest food exporting sector. Continued improvement in resource use efficiency and environmental performance is deemed critical to the industry's future growth and success (AMPC, 2013a). Energy and water use efficiency impact on production costs, profitability and competitiveness. In some regions water availability is a potential constraint on industry operations and future expansion. In addition, the industry must meet community expectations about environmental sustainability, which includes limiting greenhouse gas (GHG) emissions. Reporting of environmental performance is also a requirement of some supply chain partners and is emerging in some export markets.

Environmental performance assessment in the Australian red meat processing industry is not new. Individual red meat processing plants work actively to improve resource use efficiency and environmental performance, guided by a portfolio of strategic research undertaken by AMPC (2013b). Industry-wide environmental performance reviews have been undertaken since 1998 at approximately 5 year intervals, with the latest published in 2011 (GHD, 2011). These industry-wide reviews have been widely used for benchmarking individual performance and to support the development of applications for new and expanded red meat processing sites. The data have also been used to assess performance change over time, to support the development of industry policies, as well as for communication and training purposes.

This report continues this series of industry environmental performance reviews, presenting results for the 2013/2014 financial year. The results are broadly comparable to previous studies. However, some important changes to the methodology have been implemented to improve comparability of performance between sites and over time (see Section 2.4). It is also important to note that this review concerns environmental performance. Other economic, social and animal welfare issues contribute to the broader subject of sustainability.

2.2 Objectives

This project had four objectives:

- Revise the key performance indicator set previously used in the Australian red meat processing industry based on a review of industry sustainability and environmental reporting frameworks and consideration of environmental relevance
- Undertake statistical modeling to resolve differences in site environmental performance based on variation in animal mix and processes undertaken
- Assess critical variables having a major influence on environmental performance metrics
- Prepare an updated Environmental Performance Review of the red meat processing industry

2.3 Choice of indicators

As a first step in the process, the previous environmental performance indicator set (GHD, 2011) was reviewed against a wide range of other sustainability and environmental reporting frameworks. Special emphasis was given to frameworks covering the food processing industry and livestock sectors, both in Australia and internationally. The Appendix (Section 6.1) provides a list of frameworks and reports that were reviewed. The purpose of this exercise was to confirm a set of indicators with the highest environmental relevance to the Australian red meat processing industry as well as a high degree of coherence with other reporting frameworks. Consideration was also given to the practicality of obtaining data.

Three types of indicators were deemed relevant to environmental reporting in the Australian red meat processing industry: indicators that describe resource use efficiency, indicators that describe potential environmental impact, and indicators describing rate of adoption of good environmental management practices (Table 1).

In this report, indicators were chosen to address the six environmental issues deemed to be of highest importance to the Australian red meat processing industry (Table 2). In this regard there was no difference to the Environmental Performance Review conducted in 2010 (GHD, 2011). However, based on the review of other sustainability and environmental reporting frameworks, some minor changes were made to the specific indicators. In particular, in this report less emphasis was given to the quantity of wastewater generation, which is largely a function of water intake. Also, the indicator describing treated wastewater quality was replaced with an indicator describing quality of wastewater discharged to the aquatic environment, recognizing that it is often the case that wastewater is partially treated by red meat processors and then sent for further treatment off-site. From an environmental perspective, it is not important where wastewater treatment takes place; rather it is the quality of wastewater once it is discharged to the environment.

Table 1: Types of environmental performance indicators

TYPE OF INDICATOR	CHARACTERISTICS
Resource use efficiency	**These are quantitative indicators that describe the technical efficiency of operations, e.g. energy use efficiency, water use efficiency. The performance result is largely within the sphere of control of the business depending on technology adoption and operating practices. The major issue is that the importance of achieving a high level of efficiency may vary from one location to another, e.g. locations may differ in terms of local water stress.**
Environmental impact	**These are quantitative indicators that describe potential environmental impact: For example, global warming potential associated with GHG emissions. These indicators more closely reflect actual concern (i.e. environmental performance), but may be impacted by factors outside the direct control of the business (e.g. emissions intensity of grid electricity).**
Practices	**These indicators describe rate of adoption of good environmental management practices. The advantage is that these indicators describe concrete actions. However, their link to actual environmental impacts may be weak.**

Table 2: Key environmental performance indicators

ISSUE	DESCRIPTION	KEY INDICATORS
Water use	Water is a precious natural resource which has become scarce in many parts of Australia. Red meat processing facilities critically depend on water for their operation. As with all industrial facilities, there is a need to use water more efficiently, especially in regions where water scarcity is high. Water recycling can be used to reduce water demand, subject to food safety and other regulations.	Water use efficiency (intake/t HSCW) Demand met by recycling (%)
Wastewater emissions	Red meat processing facilities can generate wastewater streams rich in nutrients and organic matter. Good operating practices can limit wastewater contamination and treatment can be used to limit harmful emissions to the environment.	Untreated quality – P (mg/L) Untreated quality – N (mg/L) Untreated quality – BOD (mg/L) Untreated quality – FOG (mg/L) Emissions to environment – P (mg/L) Emissions to environment – N (mg/L)
Energy use	Red meat processing facilities can be important energy users, associated particularly with refrigeration, production of steam and hot water, and rendering. Energy consumption is associated with a range of environmental impacts and is an important cost of production.	Energy use efficiency (MJ/t HSCW)
Greenhouse gas emissions	Reducing greenhouse gas emissions is a major global challenge. Red meat processing facilities can play an important role in limiting direct emissions (Scope 1) as well as emissions associated with the use of electricity on site (Scope 2). Red meat processors have less agency over indirect (Scope 3) emissions and these are currently not included.	GHG emissions intensity (kg CO_2e/t HSCW) (Scope 1 and 2)
Solid waste	Red meat processing facilities can generate large quantities of organic wastes which have the potential to be beneficially recycled into new products. In addition, the production of other miscellaneous solid waste can be limited to reduce demand for new materials and the environmental impacts associated with solid waste disposal.	Solid waste to landfill (kg/t HSCW)

Local amenity	**Red meat processing facilities have the potential to emit odours and noise which can impact the amenity of the surrounding community.**	**Odour complaints (number/site/year)** **Noise complaints (number/site/year)**

2.4 Relationship to previous reports

This report forms part of a series of industry environmental performance reviews commissioned by AMPC/MLA (GHD, 1998; URS, 2005; GHD, 2011). However, as mentioned above (Section 2.1) two new features have been introduced in order to improve the comparability of indicator results between sites and over time.

Firstly, water use efficiency (kL/t HSCW) is understood to differ between plants processing large animals (cattle) and plants processing small animals (lambs and goats). Generally, plants processing small animals report marginally higher water use per t HSCW of production. As such, variation in the water use performance indicator could be the result of differences in water use efficiency or differences in the proportions of large and small animals being processed. To address this issue, a statistical model was developed, based on industry data, and used to adjust each site's water use efficiency results such that they are expressed in terms of large animal equivalents (i.e. kL/t HSCW large animal equivalents). It is now possible to compare water use efficiency between sites which have different animal mixes. It will also be possible to reliably compare performance change over time without the results being confounded by changes in animal mix (which could occur due to changes in the market preference for different meat products over time, or due to changes in the specific processing sites included in the survey). More detail about the model used to translate *reported performance* (kL/t HSCW) to *benchmark performance* (kL/t HSCW large animal equivalents) is found in the Methods section below (Section 3.3).

A second new feature of this report addresses the concern that some plants undertake the energy intensive process of rendering, whereas other plants do not. In this study, total plant energy use was disaggregated to the process of rendering (where this occurred) and to other processes (details are found in Section 3.3). It is now possible to compare energy use efficiency and GHG emissions intensity on the basis with or without rendering, making comparison between sites and over time meaningful.

Due to these changes in the method, care needs to be taken in making comparisons between indicator results found in this report and those found in earlier reports.

3.0 Method

3.1 General approach

This Environmental Performance Review of the red meat processing industry followed a similar approach to previous studies. AMPC contacted meat processing facilities and invited their voluntary participation in the project. An incentive for participation was a commitment by the project team to provide each participating site with a customized report identifying their site performance relative to the industry average. A further objective was to obtain a sample which varied in terms of size of operations, animal mix and location (i.e. northern and southern Australia).

Participating sites were sent a Microsoft Excel-based survey instrument. Completion of the survey instrument was supported by site visits, telephone and email discussions. Throughout the data collection process, data quality assessment took place, unusual data entries were explored, and qualitative interpretive information was gathered. While all red meat processing facilities share features in common, they also each have their own unique characteristics.

3.2 Sample

In total, complete data sets were obtained for 14 red meat processing facilities. This is the same as the number of sites included in the 2010 Environmental Performance Review, but a greater number than in earlier surveys (9 sites in 1998 and 10 sites in 2003). The processing facilities included in the current survey were diverse in many respects (Table 3). That said, the sample was inclined toward medium and large scale facilities. The 14 facilities included in the sample represent 9% of the approximately 150 red meat processing facilities operating in Australia, but around 34% of total red meat production in Australia in 2013/2014, which was 3.5 million t carcase weight according to the ABS 7218 series.

Table 3: The diverse characteristics of facilities included in the sample

PARAMETER	RANGE
Production	**16,288 to 220,353 t HSCW/year**
Animal mix	**Cattle only (9), Mixed (3), Small animal only (2)**
Location	**NSW (3), Qld (5), SA (2), Vic (4)**
Local water stress*	**0.01 to 0.85**
Included in previous survey	**Yes (11), No (3)**
Operations	**With rendering (12), Without rendering (2)**

** Water Stress Index of Pfister et al. (2009)*

3.3 Model development

Statistical modeling was undertaken to address two issues: the variation in animal mix between plants, and the variation in processes undertaken (i.e. whether the site conducted rendering).

Animal mix: Disaggregated water use data from processors conducting rendering were used to determine an average water use associated with this process (i.e. 1.38 kL/t HSCW). This average rendering water use was added to the site water use for the two sites where rendering was not undertaken. As such, a water use dataset for 14 sites was compiled whereby water use in rendering was included in all cases. To derive an adjustment factor for water use on the basis of animal mix, water use was modeled in terms of the t HSCW of cattle and small animals (lambs, goats) processed at each site by a linear regression. The ratio of water use coefficients for cattle and small animals provided the small animal correction factor of 1.16. In other words, the processing of small animals required on average 1.16 times the water use to process cattle (per t HSCW). This factor was used to scale the water use at all sites where small animals were processed, with the results now expressed in terms of water use per t HSCW cattle equivalents. For example, a site processing only small animals and reporting a water use of 7.8 kL/t HSCW, would have a benchmark water use efficiency of 6.7 kL/t $HSCW_{\text{cattle equivalents}}$ (i.e. 7.8/1.16). By this process, the water use at sites with differing animal mixes became comparable.

Variation in processes undertaken (i.e. rendering): Disaggregated electrical energy use data for processors conducting rendering were used to determine the average electrical energy use associated with this process (i.e. 13% of total site electrical energy use). A factor of 0.7 was used to allocate site thermal energy use to rendering. None of the transportation energy use (e.g. diesel and unleaded fuel) was allocated to rendering. By this process, energy use at sites conducting rendering was disaggregated to the rendering process and to all other processes. In so doing, the average site energy use for rendering was computed based on data from 12 sites and the average site energy use for all other activities (excluding rendering) was computed on data from 14 sites.

3.4 Analysis of impacting variables

Further analysis of the dataset explored relationships between environmental performance indicator results and a range of site variables. The range of site variables assessed included size of plant (total t HSCW processed/year), ownership (whether part of a group of processors), whether site performance targets existed (e.g. water use efficiency target, energy use efficiency target), type of rendering process (e.g. low temperature, high temperature), energy mix (e.g. proportion of site energy use in the form of electricity) and whether the site was in a location of high water stress.

4.0 Environmental performance results

4.1 Water use

This indicator tracks performance in reducing water intake, which is a shared objective in all parts of Australian industry, and especially in regions that experience water stress.

The average site water intake was 8.6 kL/t $HSCW_{cattle\ equivalent}$

The typical experience in industry is that it takes marginally more water to process small animals (e.g. lambs, goats) compared to cattle (per t HSCW). The explanation is that in some cases water demand is on a per head basis and smaller animals yield smaller carcases. As such, it is not possible to compare water use between sites and across time periods without adjusting for variation in the animal mix. In this study, reported water use has been adjusted and expressed relative to the processing of cattle (i.e. cattle equivalents, refer Section 3.3 for details).

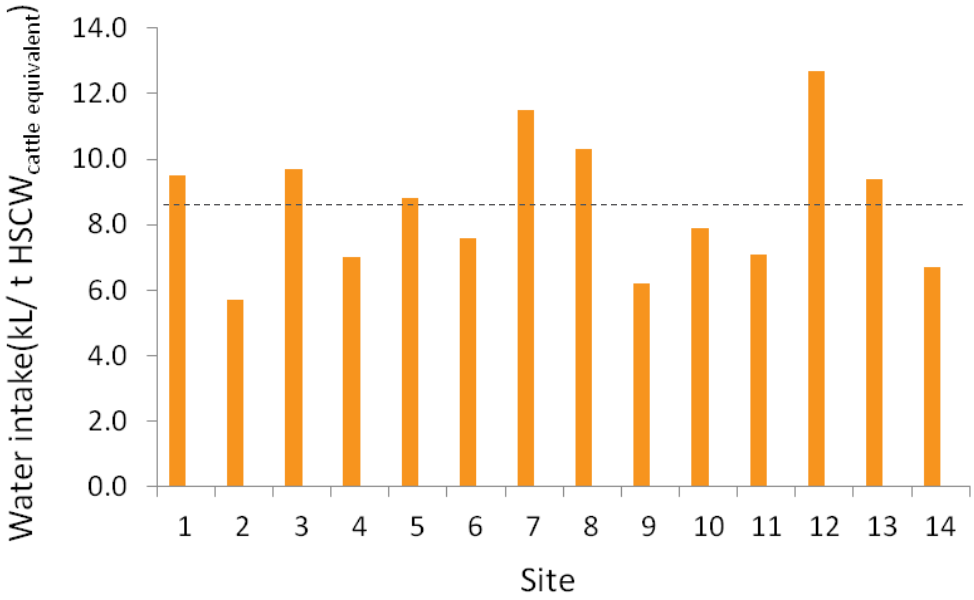
This approach is necessary in order to make valid comparisons between sites. However, it does complicate the comparison of results reported in previous environmental performance reviews where no such adjustments were made. The un-adjusted site average was 8.9 kL/t HSCW, which is slightly more than a 5% reduction compared to the 2008/2009 result of 9.4 kL/t HSCW. Based on this comparison, it is evident that the industry is about half way toward achieving the target of a 10% reduction in water intake per t HSCW (AMPC, 2012). However, as mentioned above, it is unclear whether this reduction is due to improved water use efficiency or a change in the animal mix of the facilities surveyed on each occasion.

The current result of 8.6 kL/t $HSCW_{cattle\ equivalent}$ might be compared to the result reported in 2008/2009 for the subset of facilities only processing cattle (8.7 kL/t HSCW). On this basis, a modest improvement is still evident (approximately 1%). However, it is likely that the improvement in water use efficiency is greater than 1% because the 2013/2014 site average is the sum of the average site water intake for all processes excluding rendering plus the average site water intake for rendering. As such, it represents an average that includes rendering in all cases. This compares to the 2008/2009 result which is an average of sites only some of which conducted rendering.

In summary, the evidence supports the conclusion that the Australian red meat processing industry has continued to achieve reductions in water intake per t HSCW processed, although the precise quantification of the improvement is difficult.

Water intake varied between sites from 5.7 to 12.7 kL/t $HSCW_{cattle\ equivalent}$ (Graph 1).

Graph 1: Site water intake *



** For sites without rendering, an industry average value for rendering has been added. The dashed line is the industry average.*

Considering the 14 facilities together, town water was the most important source of water intake at 87%. This is only a minor change since 2008/2009 when 83% of intake was from town water. The second most important source of water was local groundwater (bore water) at 11%. Local dams, direct withdrawal from a river and rooftop rainwater harvesting were minor sources. Considering the 14 facilities together, 13% of water demand was met by recycled water, a slight increase over 2008/2009 when 11% was reported. Five of the 14 sites reported using recycled water. This is an increase of 1 site over the 2008/2009 survey.

Almost 80% of sites reported having a water efficiency target. These sites reported a slightly better water use efficiency than sites without such a target. This highlights the importance of target setting in guiding environmental performance improvement.

There was no evidence that facility size or ownership (whether part of a large group of processors) were impacting variables. In addition, there was no evidence that water use efficiency was better at facilities located in high water stress locations, suggesting that water use efficiency was a priority regardless of the specific local context.

Ten of the 14 sites reported sub-metering of water use within the facility. This is an increase from the 6 out of 14 reported in 2008/2009.

In summary, the industry has reduced its water intake per unit of production. Most sites have a water use efficiency target and there is an increased use of sub-metering to facilitate water management. Individual sites reported a wide range of initiatives which had been implemented to achieve water use efficiency gains:

- Annual water use efficiency improvement targets
- Weekly benchmarking of site water use efficiency
- Reuse of sterilizer water
- Participation in State government water use efficiency programs
- Wastewater treatment plant under redevelopment to produce potable water
- Installed sensors on washers
- Installed additional water meters to better understand water flows
- Installed timers at hand washing stations
- Water efficient jets on cleaning equipment
- Collection of rain water
- Use of recycled water for lawns, washing cattle, cleaning yards and screens

4.2 Wastewater

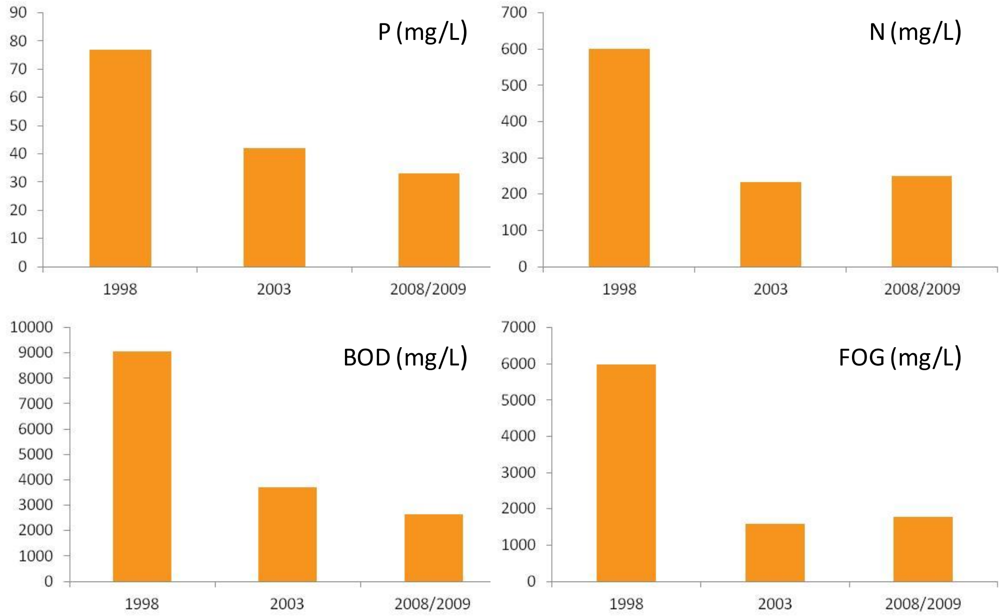
This indicator tracks performance in reducing the various environmental burdens associated with wastewater treatment and release. For example, wastewater treatment uses energy and is a source of greenhouse gas emissions. Wastewater emissions to the aquatic environment can be a source of eutrophication and have toxicity impacts on aquatic biodiversity.

Red meat processing facilities can generate wastewater streams rich in nutrients and organic matter. Good site operating practices, along with screening and floatation systems, can greatly improve the quality of wastewater. Wastewater treatment systems (on-site or off-site) can then reduce emissions to the environment.

The average site wastewater production was 8.5 kL/t HSCW. This is closely related to site water intake, subject to evaporative losses within the site and additions to the wastewater system from local rainfall.

The average site untreated wastewater profile was: phosphorus (33 mg/L), nitrogen (250 mg/L), BOD (2657 mg/L) and FOG (1780 mg/L). The P and BOD loadings were marginally lower than was reported in 2008/2009 (42 and 3707 mg/L respectively). The N and FOG loadings were marginally higher (233 and 1593 mg/L respectively in 2008/2009). The similar levels of wastewater contamination reported in the last two surveys possibly reflects the general shift in focus in the red meat processing industry toward upgrading wastewater treatment facilities to capture biogas, as described in the industry's climate change strategy (AMPC, 2012). The change in wastewater profiles over time is shown in Graph 2.

Graph 2: Comparison of industry untreated wastewater quality over time



None of the surveyed facilities discharged untreated wastewater to the environment. Almost all wastewater (>99.9%) was treated initially on-site. The very small remainder was discharged directly to sewer.

Of the 14 sites surveyed, 8 discharged wastewater to the sewer. Another 8 used treated wastewater to irrigate local farmland. Only 2 sites discharged treated wastewater directly to river.

The average nutrient content of treated wastewater discharged to rivers was: P (28 mg/L) and N (47 mg/L).

Examples of initiative to improve wastewater quality included:

- Installation of a crew press to remove more paunch solids
- Installation of a new DAF to removed solids and fats, oil and grease from effluent
- Wastewater treatment system upgrade
- Tri-canter to dewater solids and recover tallow from DAF sludge

4.3 Energy use

This indicator tracks performance in energy use efficiency. Energy consumption is associated with a range of environmental impacts and is an important cost of production.

On average, site energy use efficiency was 3005 MJ/t HSCW.

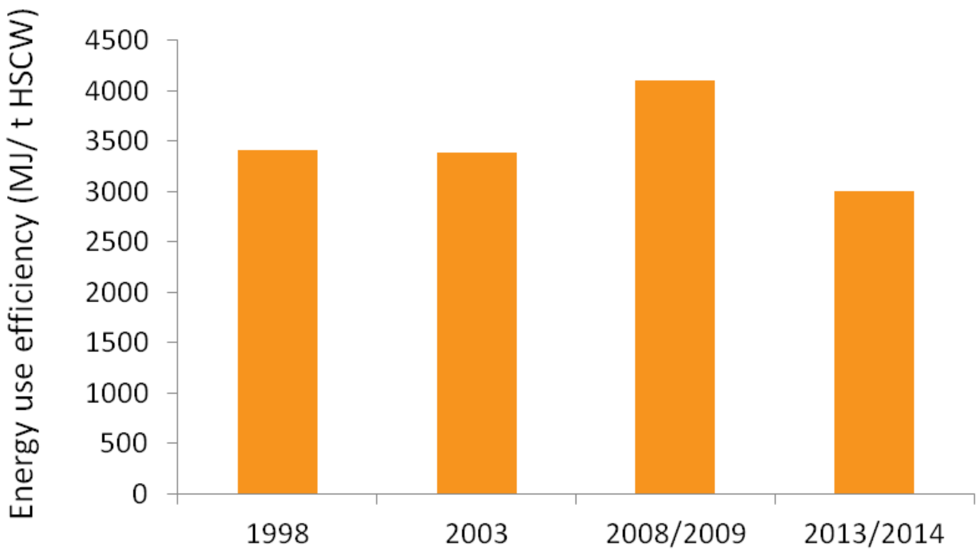
This total is the sum of two components. The first component is the industry average value for red meat processing without rendering (based on 14 sites). The second is the industry average value just for the rendering process (based on 12 sites). As such, the total represents an industry average value for red meat processing that includes rendering in all cases. If energy use associated with the rendering process was excluded, the average was 1461 MJ/t HSCW.

This represents an apparent 27% improvement in energy use efficiency since 2008/2009 when 4108 MJ/t HSCW was reported. The actual improvement since 2008/2009 could potentially be marginally greater than this because the industry average reported in 2008/2009 combined sites with and without rendering. In other words, the 2008/2009 value did not include rendering in all cases.

However, it is important to note that the result reported in 2008/2009 was much higher than in 1998 and 2003. A comparison of energy use efficiency over time is shown is Graph 3. Compared to 2003, the result in 2013/2014 was 11% lower.

It is evident that the red meat processing industry's goal of reducing energy consumption by 10% per t HSCW (AMPC, 2012) has already been exceeded.

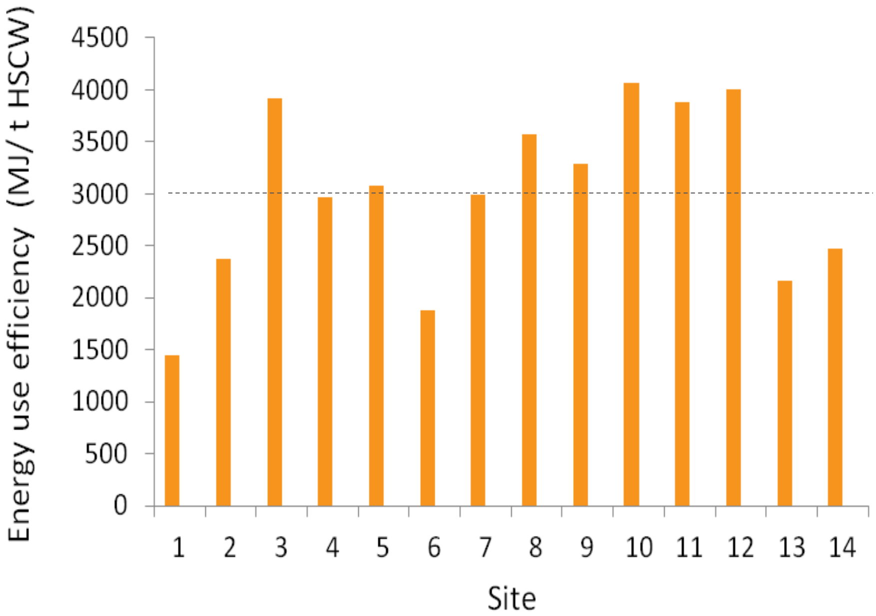
Graph 3: Comparison of industry energy use efficiency over time*



** In 2013/2014, for sites without rendering, an industry average value for rendering has been added.*

As was reported in previous environmental performance reviews of the red meat processing industry (e.g. GHD, 2011), there was a large variation in energy use efficiency between sites. Energy use efficiency (including rendering) varied between sites from 1451 to 4059 MJ/t HSCW (Graph 4).

Graph 4: Site energy use efficiency*



** For sites without rendering, an industry average value for rendering has been added. The dashed line is the industry average.*

Table 4 reports the proportion of energy use by energy source for the 14 facilities combined. The main difference compared to 2008/2009 was the use of biogas from wastewater treatment reported in the 2013/2014 survey, representing 6.6% of total energy use. Biogas generally replaced demand for natural gas. Electricity remained the largest source of energy at 35.6%, up from 31% in 2008/2009.

Table 4: Energy use by source for the 14 sites combined

Energy source	2008/2009 %	2013/2014 %
Electricity	**31**	**35.6**
Natural gas	**37**	**30.2**
Coal	**18**	**18.3**
Fuel oil	**5**	**1.4**
LPG	**2**	**0.6**
Unleaded petrol	**0**	**0.3**
Diesel	**1**	**0.4**
Biomass	**6**	**6.7**
Biogas from wastewater treatment	**-**	**6.6**

More than 70% of facilities had a formal energy efficiency target and these facilities had approximately 20% better energy use efficiency than facilities without such a target. This highlights the importance of target setting in guiding environmental performance improvement.

There was no evidence that facility size or ownership (whether part of a large group of processors) were impacting variables.

However, a significant difference in energy use efficiency was found between sites with low temperature rendering processes compared to high temperature processes, with better energy use efficiency for the former.

In summary, the industry has improved its energy use efficiency and exceeded its 10% reduction target (AMPC, 2012). For the most part, this has been achieved though the installation of more efficient equipment and the adoption of more efficient operating practices. Most sites have adopted energy efficiency targets and are monitoring, auditing and benchmarking energy use in various ways. Examples of initiatives to improve energy use efficiency include:

- Biogas capture from wastewater treatment to replace natural gas use
- Annual energy efficiency targets
- Daily gas and electricity use monitoring
- Dedicated project team tasked to identify, evaluate and implement energy efficiency improvement opportunities
- Benchmarking energy efficiency between sites
- Participation in State government energy efficiency programs
- Installation of LED and other low energy lighting
- Energy audits by consultants to identify improvement opportunities
- Increased the number of meters to better understand energy flows
- 5 year energy management and investment plan
- More efficient machines in engine room
- Variable speed drives on fans and compressors
- Replace aged equipment with energy efficient machines

4.4 Greenhouse gas (GHG) emissions

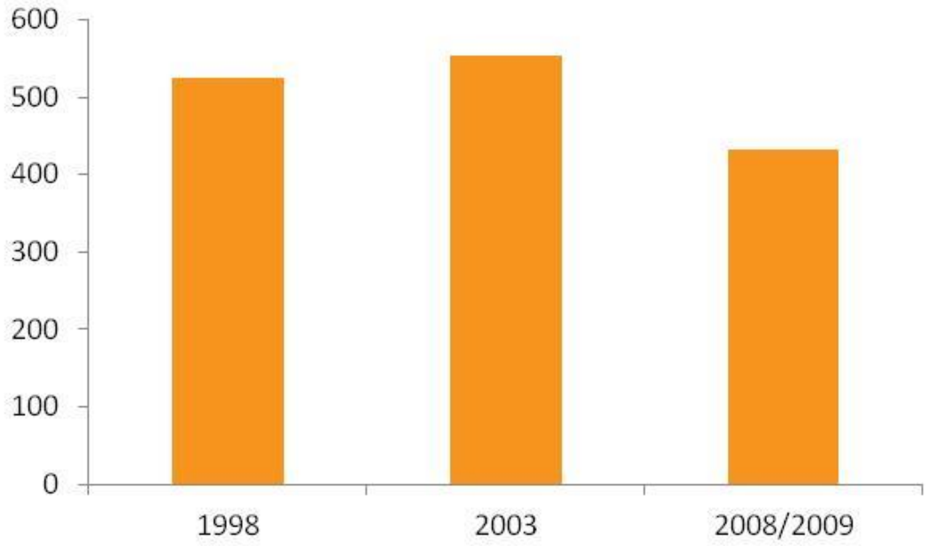
This indicator tracks performance in reducing the intensity of GHG emissions associated with red meat processing. By limiting GHG emissions, red meat processors can contribute to the important shared challenge of limiting global GHG emissions. Improvements in GHG emissions intensity also contribute to reducing the carbon footprint of red meat products, although the contribution of red meat processing is small in relation to the full product life cycle (typically between 1 and 5%).

On average, site GHG emissions were 432 kg CO_2e/t HSCW.

This total is the sum of two components. The first component is the industry average value for red meat processing without rendering (based on 14 sites). The second is the industry average value just for the rendering process (based on 12 sites). As such, the total represents an industry average value for red meat processing that includes rendering in all cases. If GHG emissions associated with the energy intensive rendering process are excluded, the average was 318 kg CO_2e/t HSCW.

This represents an apparent 22% reduction in GHG emissions intensity since 2008/2009 when 554 kg CO_2e/t HSCW was reported (Graph 5). The actual improvement since 2008/2009 could potentially be marginally greater than this because the industry average reported in 2008/2009 combined sites with and without rendering. In other words, the 2008/2009 value did not include rendering in all cases.

Graph 5: Comparison of industry GHG emissions intensity over time (kg CO_2e/t HSCW)*

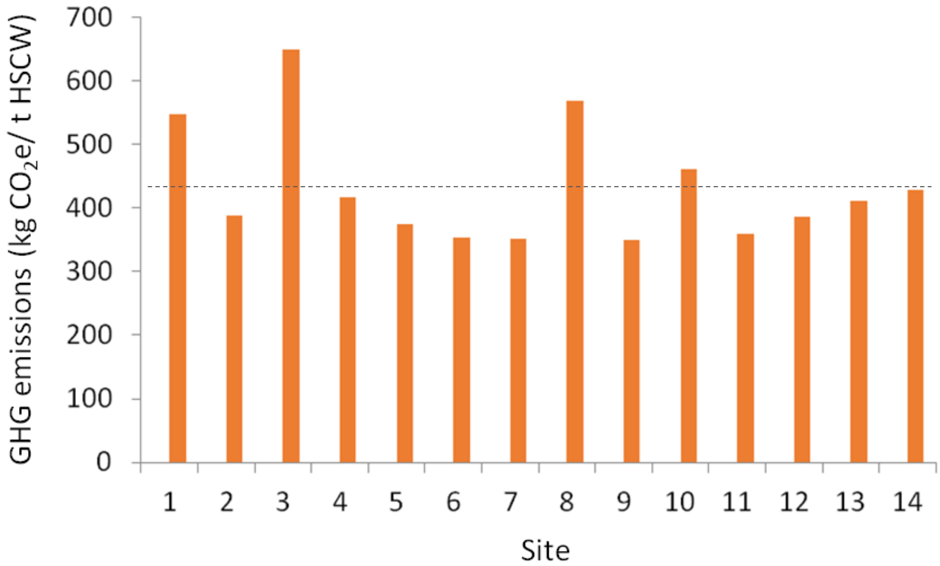


** In 2013/2014, for sites without rendering, an industry average value for rendering has been added.*

This improvement is consistent with the significant focus on GHG emissions reduction in the red meat processing sector over recent years, supported by the Red Meat Processing Industry Climate Change Strategy (AMPC, 2012). It is evident that the industry's goal of achieving a 20% reduction in GHG emissions per t HSCW has been achieved.

GHG emissions (including rendering) varied between sites from 350 to 650 kg CO_2e/t HSCW (Graph 6).

Graph 6: Site GHG emissions intensity*



** For sites without rendering, an industry average value for rendering has been added. The dashed line is the industry average.*

On average, Scope 1 emissions, being direct emissions related to the combustion of fuels on site as well as activities such as the use of refrigerants and wastewater treatment, accounted for 44% of reported site GHG emissions. The balance (i.e. 56%) was Scope 2 emissions, related to electricity consumed on site but generated elsewhere. Scope 3 indirect emissions were not included in this assessment. On average, wastewater treatment accounted for 39% of Scope 1 emissions.

Table 5 reports the proportion of GHG emissions by energy source for the 14 facilities combined. Only small changes were observed relative to 2008/2009, suggesting that the reduction in average GHG emissions intensity has been achieved primarily through energy use efficiency gains rather than substantial shifts to lower GHG intensity energy sources.

Table 5: Proportion of GHG emissions by energy source for the 14 sites combined

Energy source	2008/2009 %	2013/2014 %
Electricity	66.6	69.3
Fuel oil	2.9	0.8
Biofuels	0.1	3.6
Coal	13.3	13.0
Natural gas	15.3	12.5
Unleaded petrol	0.1	0.2
Diesel	0.6	0.2
LPG	1.1	0.3

Only 4 of the 14 sites had a formal GHG emissions reduction target and there was no evidence the sites with such a target had lower average GHG emissions intensity.

Furthermore, there was no evidence that facility size or ownership (whether part of a large group of processors) were impacting variables.

In summary, a complex array of factors determine the performance at each site in terms of GHG emissions intensity. However, the main explanation for the industry's improved performance is the gains made in energy use efficiency (Section 4.3). Interventions specifically related to GHG emission reduction mainly related to the wastewater treatment system:

- Installation of covers to existing and new anaerobic lagoons
- Biogas capture from wastewater treatment for use in boiler
- Wastewater treatment plant upgrade

4.5 Solid waste to landfill

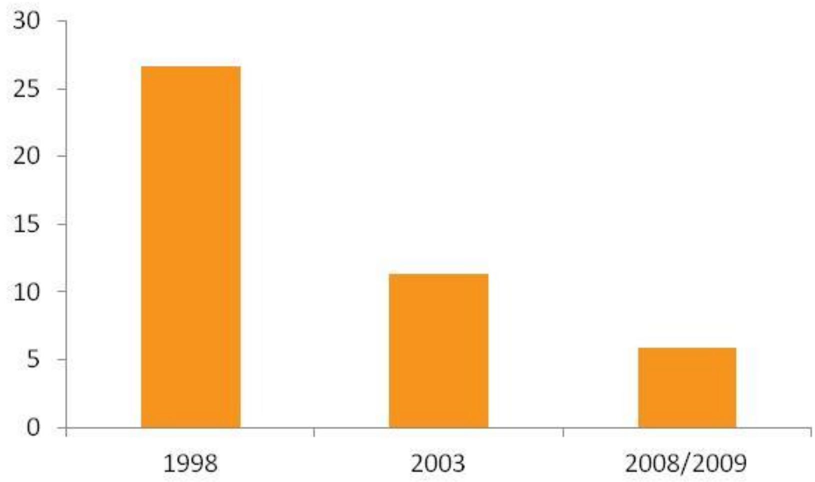
This indicator tracks performance in reducing solid waste production and landfill burden. By reducing solid waste sent to landfill, red meat processors can limit demand for new materials and the various environmental impacts associated with solid waste disposal.

Most waste generated by red meat processors is organic and comprised mainly of paunch solids, manure and yard wastes, as well as sludge from wastewater treatment plants. Organic waste is almost entirely processed into other beneficial products such as compost. Scrap metals and waste oil are also recycled. Solid waste sent to landfill is generally miscellaneous mixed waste for which local recycling pathways have not been found.

On average, solid waste sent to landfill was 5.9 kg/t HSCW.

Solid waste sent to landfill has almost halved since 2008/2009 when 11.3 kg/t HSCW was reported (Graph 7).

Graph 7: Comparison of industry solid waste sent to landfill over time (kg/t HSCW)



Approximately one third of facilities had a solid waste reduction target and these facilities produced approximately 20% less solid waste for landfill than facilities without such a target. This highlights the importance of target setting in guiding environmental performance improvement.

There was no evidence that facility size or ownership (whether part of a large group of processors) were impacting variables.

Examples of initiatives to reduce solid waste to landfill included:

- Adopting a site waste reduction KPI
- Redesigning packaging
- Development of a composting operation
- Segregation of plastics
- Process redesign to reduce production of wastes

4.6 Local amenity

This indicator tracks performance in reducing complaints about odour and noise. By controlling odour and noise emissions, red meat processors can support local amenity. This is also an aspect of social responsibility.

An issue facing some red meat processors is encroachment by residential development, bringing an increased number of sensitive neighbors into closer proximity. In such cases, odour and noise abatement has become a more significant environmental issue.

4.6.1 Odour complaints

On average, odour complaints were 7.1/site/year.

Odour complaints have decreased marginally since the 2008/2009 survey when 8.9/site/year was reported.

The major sources of odour that led to complaints were rendering and by-product plants (65%), followed by irrigation areas (20%) and wastewater treatment plants (10%).

Residential neighbors were the most common complainants (79%). Complaints from rural neighbors comprised the balance.

The incidence of odour complaints varied greatly. Almost half of the facilities recorded no odour complaints. Almost two thirds of the total number of complaints were associated with just two of the facilities. In these two cases, odour dispersion modeling had been conducted as part of a process to reduce impacts.

Examples of initiatives to reduce odour emissions included:

- Covered anaerobic lagoons for wastewater treatment
- Upgrading of bio-filters in the rendering plant
- Improved operating protocols for the rendering plant
- Improved odour monitoring system
- Minimizing on-site waste treatment

4.6.2 Noise complaints

Noise complaints were found to be far less common than odour complaints. On average, noise complaints were less than 1/site/year, and all complainants were residential neighbors.

Slightly more than half of facilities recorded no noise complaints. The maximum number recorded by any facility was 2. The sources of noise which led to complaints followed no particular pattern and included: boiler steam blow-down, a barking dog, vehicles, a squeaky conveyer and a compressor relief valve.

In the 2008/2009 survey, noise complaints similarly averaged less than 1/site/year.

5.0 Conclusions

5.1 Summary of industry performance

From 2008/2009 to 2013/2014, the red meat processing industry has achieved gains in all of the 6 key areas of environmental concern.

Due to modifications in the method used to calculate indicator results, direct quantitative comparison with results reported in previous surveys is not straightforward in all cases. However, large improvements were evident for energy use efficiency, GHG emissions intensity, solid waste sent to landfill and the control of odour emissions. A modest further improvement in water use efficiency was also evident as well as improvements in some aspects of wastewater contamination. Noise complaints remained low at an average of less than 1/site/year. A summary of indicator results is presented in Table 6.

The author should outline the outcomes from the project. This section should also include the key data sets with appropriate statistical analysis. The use of graphs and tables to summarise data is strongly encouraged. All project data should be included as an Appendix or supplied electronically.

Table 6: Summary of indicator results*

Environmental area	Indicator	Units	1998	2003	2008/09	2013/14
Water use	Water use efficiency	Intake (kL/t HSCW-cattle eq)				8.6
		Intake (kL/t HSCW)	11.8	10.6	9.4	
	Demand met by recycling	%			11	13
Wastewater	Untreated quality	P (mg/L)	11	77	42	33
		N (mg/L)	33	600	233	250
		BOD (mg/L)	639	9045	3707	2657
		FOG (mg/L)	10	5979	1593	1780
	Emissions to aquatic environment	P (mg/L)				28
		N (mg/L)				47
Energy use	Energy use efficiency	MJ/t HSCW	3411	3389	4108	3005
GHG emissions	GHG emissions intensity	kg CO_2e/t HSCW	-	525	554	432

Solid waste	**Solid waste to landfill**	**kg/t HSCW**	**7**	**26.7**	**11.3**	**5.9**
Local amenity	**Odour complaints**	**Number/site/year**	**-**	**-**	**8.9**	**7.1**
	Noise complaints	**Number/site/year**	**-**	**-**	**<1**	**<1**

** Prior to the current survey, results were combined for sites with and without rendering. In 2013/2014, for sites without rendering, an industry average value for rendering has been added in the case of water use, energy use and GHG emissions.*

In 2012, as part of the red meat processing industry climate change strategy (AMPC, 2012), goals were set to reduce water consumption per t HSCW by 10%, reduce energy consumption per t HSCW by 10% and reduce GHG emissions per t HSCW by 20% by 2015. Comparing the results for 2008/2009 and 2013/2014 in Table 6 above, it can be seen that the red meat processing industry has achieved the energy use efficiency and GHG emissions intensity goals, and is part way toward achieving the water use efficiency goal. Quantification of the improvement in water use efficiency since 2008/2009 is complicated by the result reported in 2008/2009 being an average of sites with and without rendering and sites having different animal mixes.

The sample of 14 red meat processing facilities was relatively small, but did include sites with more than ten times variation in annual throughput (16,288 to 220,353 t HSCW/year). Overall, the sample was inclined toward medium to large scale facilities. However, no evidence was found that facility size had a significant bearing on environmental performance. As such, the results presented in this report are considered representative of the industry overall.

5.2 Implications for industry

While industry-wide environmental performance improvement has been achieved, large variations were also reported between individual sites. For example, water use efficiency ranged from 5.7 to 12.7 kL/t $HSCW_{cattle\ equivalent}$. Residential odour complaints ranged from 0 to 24 per site per year. These examples of large variation between sites suggest that substantial scope still remains for further environmental performance improvement.

For some indicators, sites with an environmental improvement target achieved better results. This suggests that target setting can be a beneficial activity and an important first step that leads to the identification and implementation of environmental improvement measures. A complex array of factors determine environmental performance at each site and the prioritization of environmental improvement options and the evaluation of implementation costs and benefits needs to be conducted at the local level.

In the case of water use efficiency, most sites now have a water efficiency target and there is increased use of sub-metering to facilitate site water management. This trend was apparent across the industry and not limited to large meat processors, those sites belonging to a large corporate group, or those operating in water stressed regions. Practical measures to improve water use efficiency included increased water recycling, reuse of sterilizer water, installation of sensors on washers, and installation of water efficient jets on washers. Several sites reported the recent installation of new equipment to remove solids, fats, oil and grease from wastewater streams and thereby reduce burdens on the wastewater treatment system.

In the case of energy use efficiency, more than 70% of sites had a formal energy efficiency target and most sites were actively monitoring, auditing and benchmarking energy use in various ways. Again, this underscores the need for detailed evaluation of improvement options at the site level, supported by commitment from management to invest in improvement measures. Sites where a formal energy efficiency target existed outperformed sites without such a target by approximately 20%. Energy efficiency improvements were achieved by a combination of equipment upgrades (e.g. LED lighting, variable speed drives on fans and compressors, replacing aged and inefficient equipment) along with more efficient operating practices.

The production of this report depended on the voluntary participation of individual red meat processing businesses and their capability to supply environmental performance data. Naturally, the quality of the results reported for the industry is dependent on the quality of the site environmental performance data supplied. In this regard, it was apparent that some red meat processors had better environmental data systems than others. In addition, some smaller processors that initially expressed interest in participating had to be excluded from the study due to an inability to furnish data.

Given the increasing importance of environmental performance, a recommendation is for AMPC to develop a protocol for environmental data management and reporting. It is expected that this would especially benefit smaller processors. It would also increase the preparedness of the industry to participate in future environmental performance reviews and potentially reduce the costs of such reviews and increase the number of sites included. Given that environmental reporting is likely to be more important in future, as stakeholders and the community become more concerned about the subject, a protocol for harmonized environmental data management and reporting would be most useful. In addition, improved assessment of environmental performance is fundamental to better strategic decision making to inform investment decisions related to improving environmental performance. As such, development of a common industry protocol for environmental data management and reporting could even contribute to further gains in industry environmental performance.

Past environmental performance reviews combined results for sites with and without rendering. In addition, results were combined for sites with different animal mixes. In doing so, it has not been possible to determine whether variation in environmental performance between sites and over time was actually due to environmental performance or variation in one or more of the uncontrolled variables which have an impact on resource use. This has been overcome in the present report by use of the disaggregation and statistical modeling steps described in Sections 2.4 and 3.3. It is highly recommended that AMPC continue this approach in future Environmental Performance Reviews. As the industry progressively improves its environmental performance, and the easiest and lowest cost improvement measures are widely implemented within the industry, future additional gains will likely be smaller and reliable quantification of improvement will be difficult unless the disaggregation and statistical modeling steps described above continue to be used.

6.0 Appendices

6.1 List of sustainability and environmental reporting frameworks reviewed

- Australian Food and Grocery Council, *Towards Sustainability 2007-2008*
- Australian Food and Grocery Council, *Sustainability Supplement 2009-2010*
- Australian Food and Grocery Council, *Sustainability Commitment 2010-2011 Report*
- Australian Pork Limited, *National Environmental Sustainability Strategy for the Pork Industry 2010-2015*
- Dairy Australia, *Australian Dairy Manufacturing Industry State of the Environment Report 2004-2005. A Dairy Australia report on behalf of the Dairy Manufacturers Sustainability Council*
- Dairy Australia, *Australian Dairy Manufacturing Industry Sustainability Report 2007-2008. A Dairy Australia report on behalf of the Dairy Manufacturers Sustainability Council*
- Dairy Australia, *Australian Dairy Manufacturing Environmental Sustainability Report 2010-2011. Australian dairy companies working together for a sustainable future. A Dairy Australia report on behalf of the Dairy Manufacturers Sustainability Council*
- Australian Dairy Industry Council, *Australian Dairy Industry Sustainability Framework Progress Report 2013*
- Innovation Center for US Dairy, *Stewardship and Sustainability Guide for UD Dairy. A voluntary framework for tracking and communicating progress, Version 1.3, 2013*
- Global Dairy Agenda for Action, *The Dairy Sustainability Framework: A collaborative approach to sustainability in the global dairy sector*
- Alliance for Water Stewardship, *The AWS International Water Stewardship Standard, Version 1.0, 2014*
- Rural Industrial Research and Development Corporation, *Using Life Cycle Assessment to Quantify the Environmental Impacts of Chicken Meat Production, RIRDC Publication No. 12/029*
- International Finance Corporation, *Environmental, Health and Safety Guidelines for Meat Processing, 2007*
- United Nations Environment Programme, *Cleaner Production Assessment in Meat Processing, 2002*
- Meat and Livestock Australia, *Eco-efficiency Manuel for Meat Processing, 2002*
- Meat and Livestock Australia, *Environmental Best Practice Guidelines for the Red Meat Processing Industry, 2007*
- Global Reporting Initiative, *Sustainability Reporting in the Food Processing Sector, 2008*
- Global Reporting Initiative, *Sustainability Reporting Guidelines & Food processing Sector Supplement, 2010*

- Global Reporting Initiative, *G4 Sector Disclosures, Food Processing, 2013*
- Food and Agriculture Organization of the United Nations, *Sustainability Assessment of Food and Agriculture Systems (SAFA) Guidelines, Version 3.0, 2013*
- Food and Agriculture Organization of the United Nations, *Greenhouse gas emissions and fossil energy demand from small ruminant supply chains, Guidelines for quantification, 2014*

6.2 Review of previous indicators

ISSUE	PREVIOUS INDICATOR	COMMENTS
Water use	**Raw water usage (kL/t HSCW)** **Wastewater generation (kL/t HSCW)**	**The term "raw water" is not widely used or well defined. A clearer expression is "water intake". In regards to water use efficiency, it is necessary to resolve differences between sites and over time that are related to variation in animal mix and the processes undertaken at each site.** **Less emphasis should be given the quantity of wastewater generation as an environmental performance metric as this is largely a function of water intake.**
Wastewater emissions	**Raw nutrient releases – P, N, BOD, FOG (mg/L)** **Treated nutrient releases – P, N (mg/t HSCW)**	**The term "raw nutrient releases" is not a widely used term, especially in referring to wastewater quality prior to biological treatment. A clearer expression is untreated wastewater quality. Since red meat processors do not release untreated wastewater directly to the environment, this indicator mainly has relevance as a measure of site operational practices in avoiding wastewater contamination.** **Also, the indicator describing treated wastewater quality was replaced with an indicator describing quality of wastewater discharged to the environment, recognizing that it is usually the case that wastewater is partially treated by red meat processors and then sent for further treatment off-site. From an environmental perspective, it is not important where wastewater treatment takes place; rather it is the quality of wastewater once it is discharged to the environment.**
Energy use	**Energy usage (MJ/t HSCW)**	**The term "energy use efficiency" is more widely used in environmental and sustainability reporting.** **In regards to energy use efficiency, it is necessary to resolve differences between sites and over time that are related to variation in the processes undertaken at each site (i.e. whether rendering is undertaken).**

Greenhouse gas emissions	Greenhouse gas emissions (kg CO_2e/t HSCW)	When GHG emissions are expressed per unit of production, the term "GHG emissions intensity" is more accurate. As per energy use efficiency, it is necessary to resolve differences between sites and over time that are related to variation in the processes undertaken at each site (i.e. whether rendering is undertaken).
Solid waste	Solid waste to landfill kg/t HSCW	Indicator used without change
Local amenity	Odour complaints (number/site/year) Noise complaints (number/site/year)	Indicators used without change
Sire management performance	Self assessment of site management performance based on 8 topics (%)	Self assessment of site environmental management performance was deemed to be too subjective to be useful.

6.3 Global Warming Potentials (100 year) used in this report*

Gas	Chemical formulae	Global Warming Potential CO_2e
Carbon dioxide	CO_2	1
Methane	CH_4	21
Sulphur hexafluoride	SF_6	23,900
R404a	44±2% C_2HF_5 · 52±1% $C_2H_3F_3$· 4±2% $C_2H_2F_4$	3922
R134a	$C_2H_2F_4$	1430
R22	$CHClF_2$	1810
Acetylene	C_2H_2	3.38

** DOE (2014)*

The author should include a full interpretation of the results.

7.0 Bibliography

AMPC (2012) *Red Meat Processing Industry Climate Change Strategy*, Australian Meat Processor Corporation, North Sydney.

AMPC (2013a) *Meat Industry Strategic Plan (MISP) and Meat Processing.* Australian Meat Processor Corporation, North Sydney.

AMPC (2013b) *AMPC Strategic Plan Summary: 2013*, Australian Meat Processor Corporation, North Sydney.

DOE (2014) *National Greenhouse Accounts Factors: December 2014 Update,* Commonwealth of Australia, Department of the Environment, Canberra.

GHD (1998) *Benchmarking of Environmental Performance.* Meat & Livestock Australia, North Sydney.

GHD (2011) *Industry Environmental Sustainability Review 2010*. MLA Publication A.ENV.0086. Meat & Livestock Australia, North Sydney.

Pfister S, Koehler A, Hellweg S (2009) Assessing the environmental impacts of freshwater consumption in LCA. Environmental Science and Technology 43(11), 4098–4104.

URS Australia Pty Ltd (2005) *Industry Environmental Performance Review: Integrated meat processing plants.* MLA Publication PRENV.033. Meat & Livestock Australia, North Sydney.