Final Report

AUSTRALIAN MEAT PROCESSOR CORPORATION

Environmental Performance Review 2022

Red Meat Processing Industry

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Contents

1.0 Executive Summary

This report continues the series of environmental performance reviews of the Australian red meat processing industry that began more than 20 years ago, presenting results for the financial year ending June 30, 2022.

In total, 31 sites committed voluntarily to participate in this review, representing the highest level of participation to date, and indicative of increasing levels of commitment to sustainability by the industry. The methods used were broadly the same as previous reviews. However, to meet the reporting requirements of the Australian Beef and Australian Sheep Sustainability Frameworks, some results were calculated separately for beef cattle and for sheep. Some sites processing sheep also processed goats and other smaller animals.

The 31 sites represented almost 60% of national production. They were located across Australia and ranged greatly in production output, and although the sample was skewed toward larger processors, there was no evidence 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.

Compared to the previous review in 2020, there was improvement in some indicators, other indicators showed little change, and a few regressed.

- Water demand was 8.0 kL/t HSCW (Hot standard carcase weight), a level very similar to 2020. However, differences were observed between beef and sheep processing with beef processors increasing their water intake relative to sheep processors. This may have been a consequence of beef cattle processors operating substantially below capacity during the 2021/2022 financial year, with production more than 20% below the previous survey year.
- Wastewater quality indicators were mostly lower, and particularly so in the case of discharge to the aquatic environment where levels of phosphorus (P) and nitrogen (N) averaged 18 and 31 mg/L, respectively.
- Energy use intensity was marginally higher than in 2020 at 3435 MJ/t HSCW, and only a small difference between processors of beef cattle and sheep was evident. Previously, it has been reported that beef processing requires substantially less energy per t HSCW than sheep. As such, the results obtained in 2022 point again to inefficiencies related to lower production by beef processors in the past financial year. The trend toward greater value adding and the consolidation of operations on site that may have previously been undertaken by other separate businesses is also relevant. The contribution of biogas to total energy demand increased to 7.7%, consistent with the increasing uptake of covered anaerobic lagoons for wastewater treatment.
- GHG emissions (GHGE) were 447 kg CO_2e/t HSCW, higher than in 2020 and more like the level reported in 2015, with beef processors reporting substantially higher emissions compared to sheep processors (476 kg CO_2e/t HSCW compared to 364 kg CO_2e/t HSCW). Again, this is contrary to expectations as it has previously been reported that GHG emissions related to beef processing are ordinarily lower per t HSCW than for sheep. Once more, the inefficiencies related to lower production by beef processors in the past financial year appear to have contributed.
- Waste sent to landfill was 17.3 kg/t HSCW, a level higher than in 2022. The reasons for this are unclear. Potentially, this has to do with variable approaches to quantifying waste over time and between sites.

- Local amenity indicators both showed further improvement compared to 2020, with noise complaints more than halving to an average of 1.7 per site per year, and odour complaints being very uncommon at less than 0.1 per site per year.

Individual sites have their own unique characteristics meaning that priorities for environmental improvement need to be determined at the local site level. Nevertheless, large variation in environmental indicator results were evident across sites, suggesting that there remains ample opportunity for gains across the industry. For some indicators, sites that had set targets were observed to have marginally better environmental performance, suggesting value in target setting as a first step that leads to the identification and implementation of environmental improvement measures.

Environmental performance results tended to be more variable among smaller sites, with these sites recording some of the best and some of the worst results. It may be that some smaller sites lack resources necessary to implement environmental improvement initiatives. Some smaller sites may also be at an earlier stage in their sustainability journey. Either way, small to medium sized processors could be a focus for programs aiming to support environmental improvement in the industry.

Finally, it is also important to acknowledge that the production of this report depended on the voluntary participation of individual red meat processors and their capability to supply environmental performance data. Naturally, the quality of the results being reported depends 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. This was especially evident with the reporting of wastes produced where the reporting seemed particularly variable in detail and quality. A recommendation is for the red meat processing industry to develop a common protocol for environmental data management and reporting. It is expected that this could increase the preparedness of the industry to participate in future environmental performance reviews and improve the reliability and comparability of results. A standardised approach might also simplify the task for processors and reduce costs.

A summary of indicator results for the Australian Beef and Australian Sheep Sustainability Frameworks follows:

Indicator results for the Australian Sheep Sustainability Framework

Indicator	Description	2022
3.2.3a	Water intake, kL/t HSCW	7.2
3.2.4a	Solid waste to landfill, kg/t HSCW	29.8
4.1.1c	GHGE (Scope 1&2), kg CO_2e/t HSCW	364

Indicator results for the Australian Beef Sustainability Framework

Indicator	Description	2022
6.1b	GHGE (Scope 1&2), kg CO_2e/t HSCW	476
6.1c	Energy demand met by biogas, %	10.5
6.3b	Water intake, kL/t HSCW	8.3
7.1a	Solid waste to landfill, kg/t HSCW	12.7

2.0 Introduction

Red meat processing is a major Australian industry, employing around 35,000 people, predominantly in rural and regional areas, and is the largest food exporting sector (APMC, 2022). In 2021, Australia was the world's largest sheep and goat meat exporter and the fourth largest exporter of beef. Continual improvement in resource use efficiency and environmental sustainability is a priority (RMAC, 2019). Energy and water use efficiency impact on production costs, profitability and competitiveness. In addition, the industry is seeking to meet community expectations in terms of climate action, the protection of water quality, and local amenity.

The Australian red meat processing industry has a long history of environmental performance assessment and improvement. Individual red meat processing plants work to improve resource use efficiency and environmental performance with the support of a portfolio of strategic research undertaken by AMPC (2020). Industry-wide environmental performance reviews have been undertaken since 1998 (GHD, 1998) and have been repeated approximately every 5 years (URS, 2005; GHD, 2011, Ridoutt et al., 2015; All Energy, 2021). These industry-wide surveys have served a variety of purposes, including:

- Benchmarking individual site environmental performance
- Supporting the development of applications for new and expanded red meat processing sites
- Building trust with communities and stakeholders
- Demonstrating commitment to ongoing environmental performance improvement
- Informing strategic research investment and the development of environmental management tools and resources (e.g., All Energy, 2017; Beam Energy Labs, 2021)

Taking a whole of supply chain approach, the red meat processing industry now coordinates with the Australian Beef and Australian Sheep Sustainability Frameworks (ABSF, 2021; SSF, 2021). Consequently, the red meat processing industry is now committed to biennial environmental performance reviews.

This report continues the series of environmental performance reviews, presenting results for the financial year ending June 30, 2022.The results are broadly comparable to previous reviews. However, there are also minor differences in methodology that should be considered when comparing results over time.

It is also important to note that the scope of this report is environmental performance. There are additional economic, social, and animal welfare aspects to the broader subject of sustainability.

3.0 Project Objectives

The project had four objectives:

- Revise the Environmental Performance Review (EPR) survey instrument to improve data quality with respect to wastewater and waste materials and to achieve alignment with the requirements of the Australian Beef and Sheep Sustainability Frameworks
- Undertake statistical modelling to resolve differences in site environmental performance based on variation in animal mix and processes undertaken (e.g., rendering v not-rendering)
- Assess critical variables having a major influence on environmental performance metrics (e.g., size of operation, adoption of performance targets)
- Prepare an updated Environmental Performance Review of the red meat processing industry

4.0 Methodology

4.1 General approach

This Environmental Performance Review of the red meat processing industry followed a similar approach to previous reviews. AMPC contacted red meat processing facilities and invited their voluntary participation. An incentive for participation was the offer of a follow up appointment with an environmental consultant to discuss site-specific environmental improvement opportunities. The recruitment of survey participants sought to obtain a broad sample that varied in terms of size of operations, animal mix, and location across Australia.

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

The environmental aspects included in the review were the same as in previous reviews, with a focus on the environmental performance indicators listed in Table 1.

Table 1: Environmental performance indicators

Aspect	Description	Indicator
Water use	Water is a limited natural resource. As with all industrial facilities, there is a need to use water efficiently, especially in regions that experience scarcity. 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 (%)
Water quality	Red meat processing facilities can generate wastewater streams rich in nutrients and organic matter. Good operating practices can limit wastewater contamination and subsequent 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 large energy users, associated particularly with refrigeration, the production of steam and hot water, and rendering operations. Energy consumption is associated with a range of environmental impacts and is an important cost of production.	Energy use efficiency (MJ/t HSCW) Energy demand met by biogas (%)
GHG emissions	The red meat processing industry has committed to reducing GHG emissions. The current focus is on direct emissions (Scope 1) and emissions associated with purchased electricity (Scope 2). Red meat processors have less agency over other	GHG emissions intensity (kg CO_2e/t HSCW)

	supply chain emissions (Scope 3), and these are currently not included.	
Waste to landfill	Red meat processing facilities can generate large quantities of organic waste that have the potential to be beneficially recycled into new products. In addition, the production of other miscellaneous wastes can be limited to reduce demand for new materials and the environmental impacts associated with solid waste disposal.	Waste to landfill (kg/t HSCW)
Local amenity	Red meat processing facilities have the potential to emit odours and noise that can impact the amenity of the surrounding community.	Odour complaints (number/site/year) Noise complaints (number/site/year)

4.2 Sample

In total, 31 red meat processing sites participated in the survey from 16 different AMPC member companies. This is the highest level of participation in the Environmental Performance Review to date (Fig. 1). The sample was diverse in many respects (Table 2) and represented almost 60% of red meat processing undertaken in Australia (Table 3).

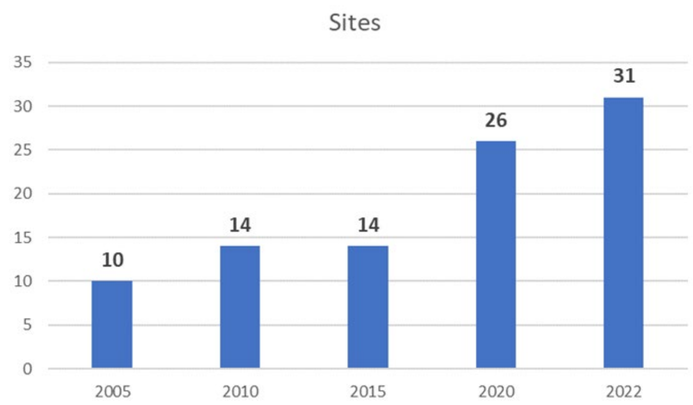

Figure 1: Number of sites participating in the AMPC Environmental Performance Review

Table 2: The diverse characteristics of sites included in the sample

Parameter	Range
Annual production	From 5,500 to 120,000 t HSCW
Animal mix	Beef cattle (19), Lamb[1] (7), Mixed (5)
Location	NSW (7), QLD (8), SA (3), TAS (2), VIC (6), WA (5)
Operations	Rendering (25), Without rendering (6)

[1] Some sites also processed goats and other small animals

Table 3: Red meat production undertaken at the sample sites compared to total Australian production

Production (2021/2022)	Sample sites	Sector[1]	%
Beef cattle (excluding veal), Mt HSCW	1.11	1.87	59.6
Mutton and lamb[2], Mt HSCW	0.40	0.68	58.8
Total processing, Mt HSCW	1.51	2.55	59.4

[1] ABS 7215 – Livestock Products Australia (ABS, 2022)

[2] Some sites also processed goats and other small animals

4.3 Model development

Sites varied in the mix of animals processed, with some sites processing single species and other sites processing a combination of beef cattle and smaller species. To provide separate reporting of environmental indicator results for the Australian beef and sheep sustainability frameworks, and to provide a reliable estimate of the red meat processing industry's overall performance (independent of the proportions of beef cattle and sheep-meat processing included in the sample), linear regression modelling was undertaken with quantity of beef cattle processed and quantity of small animals processed as input variables.

Similarly, some sites operated energy-intensive rendering plants whereas others didn't. Some sites rendered material taken in from other processors in addition to their own materials. To calculate indicator results for energy use and GHG emissions, linear regression modelling was undertaken with quantity of beef cattle processed, quantity of small animals processed, and quantity of material rendered as input variables.

GHG emissions related to anaerobic wastewater treatment were calculated following National Greenhouse and Energy Reporting methods (DISER, 2022). Australian National Greenhouse Account Factors were used to calculate GHG emissions related to the use of fuels, refrigerants, and purchased electricity (DCCEEW, 2022).

4.4 Analysis of impacting variables

Further statistical analysis of the dataset explored relationships between environmental performance indicator results and a variety of site variables. These site variables included size of operation (t HSCW processed), whether performance targets had been set (e.g., water use efficiency, energy use efficiency, GHG emissions reduction, solid waste reduction), and whether the site had installed water submetering.

5.0 Project Outcomes

5.1 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 can experience water scarcity.

On average, water intake was 8.0 kL/t HSCW. The level was marginally higher for beef cattle processors, but lower for processors of sheep, lamb and other smaller animals (Table 4).

Table 4: Comparison of water intake over time (kL/t HSCW)

Water intake	2010	2015	2020	2022
Red meat processors	9.4	8.6	7.9	8.0
Beef cattle processors				8.3
Sheep and lamb processors[1]				7.2

[1] Some sites also processed goats and other small animals

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). Unexpectedly, in this Environmental Performance Review, it was beef cattle processors that were found to require more water. The reasons are unclear but could relate to inefficiencies associated with beef cattle processors generally operating at substantial under capacity in 2021/2022 (see Section 6 for further discussion).

Water intake varied between sites from 3.8 to 14.9 kL/t HSCW.

Town water was the most important source of water intake (70%), followed by local groundwater (bore water) at 24%, and direct withdrawal from surface water (6%). This is almost identical to results reported in 2020. Recycled water met 12% of water demand, a level that is comparable to previous years (Table 5).

Table 5: Water demand met by recycled water (%)

Recycled water	2010	2015	2020	2022
Red meat processors	11	13	11	12

Water use efficiency targets were reported by 68% of sites, an increase from 60% in 2020. The use of water submetering was reported by 77% of sites, a large increase from 28% in 2020. These results suggest that water use efficiency is a current focal area for improvement across the red meat processing industry. However, sites that had adopted targets and installed submetering did not necessarily achieve greater water use efficiency that those that had not.

Similarly, there was no evidence that facility size was an impacting variable. However, it was observed that smaller sites were more variable in water use efficiency.

Examples of new initiatives to improve water use efficiency included:

- Participation in the AMPC water metering program

- Diversion of stick water for use in rendering cooker
- Diversion of condensate water for use in cleaning
- Diversion of steriliser overflow water to clean cattle yards
- Flow limiting nozzles on hand wash stations
- Trialling RO (reverse osmosis) system
- Installation of water saving high pressure cleaning system

5.2 Wastewater

This indicator tracks performance in reducing the various environmental burdens associated with wastewater treatment and release. Good operating practices can limit wastewater contamination and subsequent treatment can limit harmful emissions to the environment.

On average, water discharge was 7.1 kL/t HSCW (89% of water intake). The amount was marginally higher for beef cattle processors (7.3 kL/t HSCW; 89% of intake), but lower for processors of sheep, lamb and other smaller animals (6.6 kL/t HSCW; 92% of intake).

The average untreated wastewater profile was: phosphorus (36 mg/L), nitrogen (169 mg/L), biochemical oxygen demand (BOD, 2171 mg/L), and fats, oils and grease (FOG, 1256 mg/L), continuing a broadly downward trend over time (Table 6).

Table 6: Comparison of untreated water quality over time (mg/L)

Indicator	2010	2015	2020	2022
Phosphorus	42	33	30	36
Nitrogen	233	250	175	169
Biological oxygen demand	3707	2657	2257	2171
Fats, oils and grease	1593	1780	1143	1256

Wastewater was discharged mainly via irrigation (47%) or sewer (35%). Lesser amounts of treated wastewater were discharged to rivers (17%). No untreated wastewater was discharged to the environment.

The average nutrient content of treated wastewater discharged to rivers was: phosphorus (18 mg/L) and nitrogen (31 mg/L), with nutrient loadings decreasing over time (Table 7).

Table 7: Nutrients discharged to rivers via wastewater (mg/L)

Indicator	2010	2015	2020	2022
Phosphorus		28	44	18
Nitrogen		47	99	31

Examples of new initiatives to improve wastewater treatment and use included:

- Partnering with local water treatment facilities to generate renewable electricity

- Automation of wastewater treatment systems
- Investment in improved upstream treatment (screw press, DAF, etc.)
- Planning undertaken to enable future discharge to field irrigation
- Expanding uses for recycled water on site

5.3 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, energy use was 3435 MJ/t HSCW. The level was marginally lower for beef cattle processors, but higher for processors of sheep, lamb and other smaller animals (Table 8), as was reported in 2010.

Table 8: Comparison of energy use over time (MJ/t HSCW)

Energy use	2010	2015	2020	2022
Red meat processors	4108	3005	3316	3435
Beef cattle processors				3420
Sheep and lamb processors[1]				3477

[1] Some sites also processed goats and other small animals

Total energy use was disaggregated into energy use for processing (2395 MJ/t HSCW) and energy use for rendering (1040 MJ/t HSCW).

Since 2015, the trend in energy use has been upward (Table 8). This may be a consequence of the red meat processing industry operating well below capacity across the 2021/22 year (see Section 6 for further discussion). The trend toward greater value adding and production of retail ready cuts could also be contributing. Furthermore, the larger sample included in this Environmental Performance Review could have included sites new to the survey and at an earlier stage in their sustainability journey.

Energy use efficiency varied between sites from 1423 MJ/t HSCW (for a site not performing rendering) to a high of 9016 MJ/t HSCW.

The mix of energy sources is shown in Table 9. Electricity from grid and natural gas remained the largest sources of energy used. However, an increase in use of biomass and biogas from wastewater treatment was apparent compared to 2020.

Energy use efficiency targets were reported by 68% of sites, an increase from 36% in 2020. This suggest that energy use efficiency is a current focal area for improvement across the red meat processing industry. Sites that had set a target had marginally lower energy use intensity, suggesting value in target setting. However, the variation between sites was large and the difference was not statistically significant.

There was no evidence that facility size was an impacting variable. However, it was observed that smaller sites were more variable in energy use intensity.

Examples of new initiatives to improve energy use efficiency included:

- Upgrading of refrigeration compressors and water pumps

- Installation of LED lighting
- Thermal scanning to identify heat losses
- Weekly energy performance monitoring
- Audit by external energy consultant
- Installation of variable speed drives for motors

Table 9: Energy use by source (%)

Energy source	2020	2022
Electricity from grid	34.6	32.0
Natural gas	30.3	30.3
Coal	19.5	14.5
Biomass	3.6	8.3
Biogas from wastewater treatment	5.8	7.7
Fuel oil	2.6	3.3
Diesel	1.8	1.9
LPG	1.6	1.9
Wind, solar	-	0.1
Unleaded petrol	0.04	0.1

5.4 Greenhouse gas 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 shared challenge of limiting the increase in global average temperature to well below 2 °C above pre-industrial levels as expressed in the Paris Agreement. 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.

On average, GHG emissions were 447 kg CO_2e/ t HSCW. The level was higher for beef cattle processors, but lower for processors of sheep, lamb and other smaller animals (Table 10).

Table 10: Comparison of GHG emissions over time (kg CO_2e/ t HSCW)

GHG emissions	2010	2015	2020	2022
Red meat processors	554	432	397	447
Beef cattle processors				476
Sheep and lamb processors[1]				364

[1] Some sites also processed goats and other small animals

Total GHG emissions were disaggregated into emissions related to processing (346 kg CO_2e/ t HSCW) and emissions related to rendering (101 kg CO_2e/ t HSCW).

GHG emissions intensity for beef cattle processing was higher than in 2020 (Table 10). The reason likely relates to inefficiencies associated with beef cattle processors generally operating at substantial under capacity in 2021/2022 (see Section 6 for further discussion).

GHG emissions intensity varied between sites from 93 kg CO_2e/ t HSCW (for a site purchasing carbon neutral electricity and not operating any anaerobic wastewater treatment) to a high of 1131 kg CO_2e/ t HSCW (a site mainly using coal as an energy source and operating a deep anaerobic lagoon for wastewater treatment without biogas capture). That said, the latter site was in the process of exploring wastewater management options.

On average, electricity from the grid made the greatest contribution to GHG emissions (Table 11). The next most important GHG emissions sources were Scope 1 - energy (associated with fuel combustion on site) followed by wastewater treatment. Refrigerant gases made only a very small contribution. That said, the combinations of GHG emission sources varied considerably between sites.

Table 11: GHG emissions by source (%)

Source	Electricity from grid	Scope 1 - energy	Wastewater treatment	Other
Red meat processors	52.6	27.1	19.9	0.4

GHG emission reduction targets were reported by 52% of sites, an increase from 20% in 2020. This suggest that GHG emissions reduction is an increasingly important focal area for improvement across the red meat processing industry. Sites that had set a target had marginally lower GHG emissions intensity, suggesting value in target setting. However, the variation between sites was large and the difference was not statistically significant.

There was no evidence that facility size was an impacting variable. However, it was observed that smaller sites were more variable in energy use intensity.

Examples of new initiatives to reduce GHG emissions included:

- Installation of covered anaerobic lagoon
- Installation of biogas capture system due for completion in 2023
- Energy use efficiency actions
- Installation of cogeneration (heat and power) plant
- Purchase of certified carbon neutral electricity

5.5 Waste to landfill

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

Most waste generated by red meat processors is organic, comprised mainly of paunch solids, manure and yard wastes, as well as sludge and pond crusts from wastewater treatment plants. Organic waste is almost entirely processed into other beneficial products, such as compost. Scrap metals and waste oil are also typically recycled.

Solid waste sent to landfill was mostly miscellaneous mixed waste for which local recycling pathways have not been found.

On average, waste sent to landfill was 17.3 kg/t HSCW. The amount was less for beef cattle processors, but higher for processors of sheep, lamb and other smaller animals (Table 12).

Table 12: Comparison of waste sent to land fill over time (kg/t HSCW)

Waste to landfill	2010	2015	2020	2022
Red meat processors	11.3	5.9	11.9	17.3
Beef cattle processors				12.7
Sheep and lamb processors[1]				29.8

[1] Some sites also processed goats and other small animals

The recorded waste sent to landfill was higher in 2022 than in past years. It is possible that this was due to more complete record keeping practices aligned with a heightened awareness of sustainability. It is not otherwise expected that red meat processors would have materially increased waste production over this period. There could be benefit from having an agreed standardised approach to waste management record keeping across the industry. This could improve the comparability of data over time.

Approximately 30% of sites had a solid waste reduction target. These sites sent less waste to landfill per t HSCW than sites without a target, suggesting a benefit from target setting. However, the variation between sites was large, and the difference was not statistically significant.

There was no evidence that facility size was an impacting variable. However, it was observed that smaller sites were more variable in waste sent to landfill.

Examples of new initiatives to reduce waste to landfill included:

- Using new pallet wrap with increased stretch enabling less plastic use overall
- Trialling a carton stacking technique that eliminates the need for some plastic pallet wrap
- Direct printing to cartons to eliminate paper labels
- Further segregation of waste streams to facilitate recycling

5.6 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 and a positive relationship with local communities.

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

5.6.1 Odour

Odour complaints averaged 1.7/site/year, which is less than half the frequency recorded in the previous review (Table 13).

Table 13: Comparison of odour complaints over time (number/site/year)

Odour complaints	2010	2015	2020	2022
Red meat processors	8.9	7.1	3.8	1.7

All the odour complaints came from residential neighbours. The major sources of odour were rendering (39%), wastewater treatment (32%), and animal manure (29%).

The incidence of odour complaints varied greatly. More than half of the sites recorded no odour complaints. More than 60% of total complaints were associated with just four of the sites. In these four cases, odour dispersion modelling had been undertaken as part of a process to reduce impacts.

Examples of new initiatives to reduce odour emissions included:

- Enclosures for by-product transit areas
- Restriction of hours for compost transportation
- Optimisation of fan speeds
- Installation of biofilter systems
- Regular cleaning of animal pens
- Routine performance assessment of odour abatement systems

5.6.2 Noise

Noise complaints were uncommon, averaging less than 0.1/site/year, and even less frequent than previous years (Table 14).

Table 14: Comparison of noise complaints over time (number/site/year)

Noise complaints	2010	2015	2020	2022
Red meat processors	<1	<1	<1	<0.1

All the noise complaints came from residential neighbours. Two sites each recorded a single complaint, one was associated with a rendering plant, and the other was associated with trucks and cattle unloading.

Examples of new initiatives to reduce noise emissions included:

- Installation of sound absorption panels
- Installation of acoustic lagging
- Restriction of operating hours for certain unit operations
- Frequent maintenance scheduling
- Monitoring of known sources of noise

6.0 Discussion

This Environmental Performance Review was undertaken only 2 years since the last review in 2020. This compares to the previous 5-year cycle of reviews. Due to the shorter interval, differences in environmental performance were not expected to be as large as reported previously.

Another overarching factor was the lower levels of output by the red meat processing industry during the 2021/22 financial year (Table 15). Overall, red meat industry processing was more than 16% lower than 2 years previously. While processing of mutton and lamb was marginally lower, processing of beef cattle was more than 20% lower. Difficulties in the operating environment, including people shortages, challenges in livestock supply, and disruptions to export supply chain logistics were all factors (AMPC, 2022). Plants are typically the most resource use efficient when operating at full capacity, so the 2022 Environmental Performance Review results need to be interpretated in this context. To quote one processor:

"We have maximum capacity of around 500 head / day, but have been at around 350… Our energy consumption would not be markedly different… Our expectation is that we'll see significant improvement as time progresses as we are headed toward higher throughput currently"

Table 15: Red meat processing industry output

Production[1]	2019/2020	2021/2022	Change (%)
Beef (excl veal), Mt HSCW	2.35	1.87	-20.4
Mutton and lamb, Mt HSCW	0.69	0.68	-1.8
Total, Mt HSCW	3.04	2.55	-16.1

[1] ABS 7215 Livestock Products, Australia, Tables 9,11,12

Overall, the 2022 Environmental Performance Review saw improvements in some indicators, such as those relating to wastewater quality and local amenity, some showed little change, and a few regressed (Table 16). The reason for some indicators regressing could relate to the abovementioned inefficiencies related to lower production. Other reasons could include higher levels of value adding, more complete reporting of resource use and emissions, and a larger sample of processors including some processors at an earlier stage on the sustainability journey.

Table 16: Summary of Environmental Performance indicators

Indicator	2010	2015	2020	2022
Water intake (kL/t HSCW)	9.4	8.6	7.9	8.0
Water demand met by recycling (%)	11	13	11	12
Untreated wastewater (mg/L)				
Phosphorus	42	33	30	36
Nitrogen	233	250	175	169
Biological oxygen demand	3707	2657	2257	2171
Fats, oils and grease	1593	1780	1143	1256

Nutrients discharged to rivers (mg/L)				
Phosphorus		28	44	18
Nitrogen		47	99	31
Energy use (MJ/t HSCW)	4108	3005	3316	3435
Energy demand met by biogas (%)			5.8	7.7
GHG emissions (kg CO_2e/t HSCW)	554	432	397	447
Waste to landfill (kg/t HSCW)	11.3	5.9	11.9	17.3
Local amenity				
Odour complaints (no/site/year)	8.9	7.1	3.8	1.7
Noise complaints (no/site/year)	<1	<1	<1	<0.1

Regarding water use, the overall water demand in 2022 remained similar to 2020. However, differences between beef and sheep processing were evident with beef processors increasing their water use relative to sheep processors (Table 4). This finding is consistent with beef processors operating substantially below capacity (Table 15). If processing levels increase, it can be expected that future gains in water use efficiency will become evident as the majority of industry have water use efficiency targets, have installed sub-metering to improve understanding of water flows within the site, and many were actively engaged in water use efficiency projects.

Continuing improvement was achieved across most wastewater quality indicators (Table 16). In some cases, improvements in wastewater quality were enabling greater reuse of water on site, thereby reducing water demand. In particular, the quality of wastewater being discharged to the aquatic environment was improved, with phosphorus at 18 mg/L and nitrogen at 31 mg/L.

Energy use in 2022 was marginally higher than in 2020 (Table 16) and there was only a small difference between processors of beef cattle and sheep (Table 8). Previously, it has been reported that beef processing requires substantially less energy per t HSCW than sheep (GHD, 2011). As such, the results obtained in 2022 point again to inefficiencies related to lower production by beef processors in the past financial year. The trend toward greater value adding and the consolidation of operations on site that may have previously been undertaken by other separate businesses is also relevant (All Energy, 2021). The increasing level of energy demand met by biogas from onsite anaerobic wastewater treatment is consistent with the gradually increasing uptake of these technologies. This is expected to further increase as several processors indicated they are either planning or in the process of installing covered anaerobic lagoons.

GHG emissions in 2022 were higher than in 2020 and more like the level reported in 2015 (Table 16), with beef processors reporting substantially higher emissions compared to sheep processors (476 kg CO_2e/t HSCW compared to 364 kg CO_2e/t HSCW, Table 10). Again, this is contrary to expectations as it has previously been reported that GHG emissions related to beef processing are ordinarily lower per t HSCW (GHD, 2011). Once more, the inefficiencies related to lower production by beef processors in the past financial year appear to have contributed. Purchased electricity, fuel combustion and wastewater treatment were the major sources of emissions, though the combinations of GHG emission sources varied considerably between sites. For example, some sites undertake only limited wastewater treatment to meet requirements for discharge to a municipal wastewater treatment plant. In such cases, emissions related to anaerobic wastewater treatment are outside the scope of the review. On the other hand, anaerobic treatment of wastewater within the site can contribute substantially to overall site emissions without biogas capture and either flaring or reuse within the plant. There are also important differences in GHG emissions intensity of purchased electricity with variation more than 2-fold between state grids, with the highest emissions in Victoria and the lowest emissions in South Australia (DCCEEW, 2022). One processor reduced their site GHG emissions by purchasing certified carbon neutral electricity. That said, higher energy use associated with running retail-ready production lines and expanding on-site chilling and freezing capacity will tend to elevate GHG emissions reported by red meat processors. Such factors complicate the comparison of indicator results over time. As mentioned above, several sites reported projects to install covered anaerobic lagoons and biogas capture systems. These projects will contribute to lower future emissions. Other sites reported a focus on energy use efficiency. There is also interest in solar PV with almost 30 MW of capacity either installed or in the process of installation (Bean Energy Labs, 2021). The energy yield from solar PV is variable and potential differs from one location to another. Currently, the contribution of solar PV to total red meat industry energy demand is growing, but probably still represents less than a few percent. Overall, the variation in GHG emissions intensity between sites was large, suggesting major opportunities for improvement at some sites. However, the achievement of carbon neutrality by the red meat processing industry in the near term would likely need to rely substantially on offsetting.

Red meat processors produce large amounts of organic waste which are mainly processed into other beneficial products, such as compost. Processors also reported the recycling of a wide range of other waste streams including plastics, metals, batteries, waste oil, and demolition materials. Nevertheless, waste sent to landfill was reported to be higher in 2022 than in 2020 (Table 16). The reasons for this are unclear. Potentially, this has to do with variable approaches to quantifying waste over time and between sites.

Regarding local amenity, odour and noise complaints continued to decline in 2022 (Table 16), supported by a variety of abatement measures.

6.1 Beef and sheep sustainability framework metrics

This is the first year of disaggregated reporting of indicator results for the Australian beef and sheep sustainability frameworks (ABSF, 2021; SSF, 2021). The relevant indicators are summarised in Tables 17 and 18.

Table 17: Indicator results for the Australian Sheep Sustainability Framework

Indicator	Description	2022
3.2.3a	Water intake, kL/t HSCW	7.2
3.2.4a	Solid waste to landfill, kg/t HSCW	29.8
4.1.1c	GHGE (Scope 1&2), kg CO_2e/t HSCW	364

Table 18: Indicator results for the Australian Beef Sustainability Framework

Indicator	Description	2022
6.1b	GHGE (Scope 1&2), kg CO_2e/t HSCW	476
6.1c	Energy demand met by biogas, %	10.5
6.3b	Water intake, kL/t HSCW	8.3
7.1a	Solid waste to landfill, kg/t HSCW	12.7

7.0 Conclusions and recommendations

The 2022 Environmental Performance Review of the red meat processing industry attracted a high level of participation, with input from 31 sites representing almost 60% of national production. The individual sites were located across Australia and ranged greatly in size, and although the sample was skewed toward larger processors, there was no evidence 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.

Compared to the previous review in 2020, there was improvement in some indicators, such as those relating to wastewater quality and local amenity, some indicators showed little change, and a few regressed. Higher energy use intensity (MJ/t HSCW) and GHG emissions intensity (kg CO_2e/t HSCW) were observed for beef cattle processing. This may have been a consequence of beef cattle processors operating substantially below capacity during the 2021/2022 financial year, with production more than 20% below the previous survey year. If so, environmental performance can be expected to improve as production levels increase.

While it is difficult to generalise because individual red meat processing sites have their own unique characteristics, large variations in environmental performance were evident between sites. This suggests that there remains ample opportunity for gains in environmental improvement across the industry. For some indicators, sites that had set targets were observed to have marginally better environmental performance, suggesting value in target setting.

Environmental performance indicator results also tended to be more variable among smaller sites, with these sites recording some of the best and some of the worst results. It may be that some smaller sites lack resources necessary to implement environmental improvement initiatives. Some smaller sites may also be at an early stage in their sustainability journey. Either way, small to medium sized processors could be a focus for programs aiming to support environmental improvement in the industry.

It is also important to acknowledge that the production of this report depended on the voluntary participation of individual red meat processors and their capability to supply environmental performance data. Naturally, the quality of the results being reported depends 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. This was especially evident with the reporting of wastes produced, where the reporting seemed particularly variable in detail and quality. A recommendation is for the red meat processing industry to develop a common protocol for environmental data management and reporting. It is expected that this could increase the preparedness of the industry to participate in future environmental performance reviews and improve the reliability and comparability of results. This might also benefit smaller processors and sites that are not part of a corporate structure. A standardised approach might also simplify the task for processors and reduce costs. Finally, to improve the comparability of Environmental Performance Review results over time, it is critical that consistent methods are used to calculate indicator results.

8.0 Bibliography

ABS (2022) *7215 Livestock Products, Australia*. Australian Bureau of Statistics, Canberra.

ABSF (2021) *Australian Beef Sustainability Framework. Annual Update 2021*. Red Meat Advisory Council, Barton, ACT.

All Energy (2021) *2020 Environmental Performance Review (EPR) for the Red Meat Processing (RMP) Industry*. Australian Meat Processor Corporation, North Sydney.

All Energy Pty Ltd (2017) *Review of Renewable Energy Technology Adoption within the Australian Red Meat Industry.* MLA Publication V.SCS.0003. Meat & Livestock Australia, North Sydney.

AMPC (2020) *Strategic Plan 2020-2025*. Australian Meat Processor Corporation, North Sydney.

AMPC (2022) *Annual Report 2021–2022. Driving Innovation in Red Meat Processing*. Australian Meat Processor Corporation, North Sydney.

Beam Energy Labs (2021) *Desktop Review of Existing Penetration of Solar at Member Sites*. Australian Meat Processor Corporation, North Sydney.

DCCEEW (2022) *Australian National Greenhouse Accounts Factors*. Australian Government, Department of Climate Change, Energy, the Environment and Water, Canberra.

DISER (2022) National Greenhouse and Energy Reporting (Measurement) Determination 2008. Compilation 14. Australian Government, Department of Industry, Science, Energy and Resources, 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.

Ridoutt B, Sanguansri P, and Alexander D. (2015) *Environmental Performance Review: Red Meat Processing Sector 2015.* AMPC Publication 2013-5047. Australian Meat Processor Corporation, North Sydney.

RMAC (2019) *Red Meat 2030*. Red Meat Advisory Council, Barton, ACT.

SSF (2021) *Australian Sheep Sustainability Framework*. Sheep Sustainability Framework, North Sydney.

URS Australia (2005) *Industry Environmental Performance Review: Integrated Meat Processing Plants*. MLA Publication PRENV.033. Meat & Livestock Australia, North Sydney.