Dairy Australia
Your Levy at Work

dmsc dairy manufacturers sustainability council

2010 | 2011 Australian Dairy Manufacturing Environmental Sustainability Report

Australian dairy companies working together for a sustainable future

A Dairy Australia report on behalf of the Dairy Manufacturers' Sustainability Council

Reducing Environmental Impact

The dairy industry strives to improve efficiencies and embrace innovation to reduce our environmental impact. The industry is investing in ways to reduce energy use; improve nutrient, land and water management; adapt to climate variability; enhance biodiversity; increase resilience; and reduce waste.

Dairy manufacturing sustainability scorecard 2010/11

Environmental performance

30% **RECYCLED**

30% of all solid waste recycled with 10,200 t reduction in solid waste sent to landfill

1,000ML **INCREASE**

1000 ML increase in fresh water consumption

1.7% **REDUCTION**

1.7% (181,613 GJ) reduction in total electricity and thermal energy consumption

243kt **INCREASE**

243 kt increase in total greenhouse gas emissions

40% **REDUCTION**

Chemical use reduced 40% to 1.2 t chemicals for every ML of raw milk processed

Economic performance

3rd **LARGEST**

Dairy was 3rd largest rural industry in Australia[1]

$3.9 **BILLION**

Generated $3.9 B of economic contribution at farm-gate[2]

43% **EXPORTED**

43% of Australian milk production exported as range of dairy products[3]

2.5/1 **MULTIPLIER**

Regional economic multiplier of $2.50 for every dollar invested in dairy industry[4]

Social performance

1 IN 10 **JOBS**

Dairy continued to represent significant proportion of agricultural enterprises in Tasmania and Victoria; almost one in ten jobs in Western Victoria were in dairy (7.3% farming, 2.4% manufacturing)[5]

40,000 **EMPLOYED**

Approximately 40,000 people directly employed on dairy farms and in dairy manufacturing throughout Australia[6]

1 2011, Dairy Australia. Dairy in Focus 2011
2 Ibid
3 Ibid
4 2011, Dairy Australia. Dairy in Focus 2011 (From Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) Farm Survey)
5 2011, Dairy Australia. 2011 Dairy People Factfinder
6 2011, Dairy Australia. 2011 Dairy People Factfinder

Foreword

Sustainability is vital to the future competitiveness of the Australian dairy industry. For this reason, the industry is committed to on-going improvements in our sustainability performance, across the entire supply chain.

As one component within the dairy supply chain, the manufacturing sector in Australia has been reporting on its collective environmental performance since 2005. This report represents the latest update on this performance and communicates our activities against a range of environmental indicators.

The next phase of our work will feature a whole of dairy Sustainability Framework that will expand our management and reporting across the supply chain. This will incorporate reporting of performance across the supply chain against:

- **Enhancing livelihoods**
- **Improving wellbeing (people and animals)**
- **Reducing environmental impact**

The Sustainability Framework adopted by the dairy industry in 2012 (subsequent to the data collection excercise for this report), now leads the industry's efforts to be more sustainable and to drive the necessary practice change. It is a Framework for keeping the Australian dairy industry competitive, nationally and internationally, for the long term.

To support the Sustainability Framework, a new approach and architecture for future sustainability reporting will evolve. It is expected that the next dairy sustainability report for 2013/14 will reflect this new approach and will include yet-to-be determined performance targets.

We are proud of the progress we have made to date and look forward to sharing with you the next phase of our work.

Ian Halliday

Executive Summary

This is the third triennial report on environmental sustainability in the Australian dairy manufacturing industry. Covering the financial year 2010/11, this report compares the industry's performance against data previously published for 2005 and 2007/08.

Progress has been made towards improving the environmental management of the dairy manufacturing industry since the first benchmark report was published in 2005. This progress has partly been driven by State and Commonwealth requirements for reporting on both energy use and related emissions, for example via the EREP, EEO and NGERS programs. Actual outcomes from this improved environmental management were however mixed during 2010/11 in terms of comparative performance against individual KPIs.

Significant improvement was seen in the KPI for chemical-use intensity, down 40% at 1.2 tonnes chemicals used / ML milk processed and for landfill with 30% of all solid waste now recycled. The KPI for energy use was however closer to neutral with a 2% reduction in total energy to 10.7 million GJ but with a 3% increase for energy intensity of an additional 41 GJ / ML milk processed[7]. In contrast, the KPIs for water and emissions related intensities all increased significantly: fresh water use increased 12% to 1.75 ML fresh water / ML milk processed; wastewater increased 12% to 1.9 ML / ML milk processed; greenhouse emissions increased 20% to 179 tonnes CO_2-e / ML milk processed.

Changes in the mix of dairy products since the first report of 2005 continued during 2010/11 with increased production of cheese and fresh dairy products but a reduction in powder products. Based on the data available, cheese and fresh dairy (as categories) each had higher water-use intensities than dairy powder. Interpretation of the above changes in water-related KPIs as negative trends cannot therefore be made with certainty as they are impacted by this change in the relative mix of product types. However, the relative impact of product mix on resource intensities cannot itself be quantified as the KPIs for water and energy were reported using aggregated data. As an example, although it is expected that the energy efficiency of powder plants would have decreased as the total volume of milk processed to powder dropped during 2010/11, the data available was insufficient to quantify this relationship.

On an absolute basis, the resource efficiency data for 2010/11 can be regarded as the most accurate collected by the Australian dairy manufacturing industry to date and should be considered as the best benchmark for future comparison of the industry's performance.

[7] Energy intensity of 1,319 GJ/ML was incorrectly reported in 2007/08. The corrected energy intensity performance was 1,300 GJ/ML

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Introduction

This is the third triennial report on environmental sustainability in the Australian dairy manufacturing industry. Covering the financial year 2010/11, this report compares the industry's performance against data previously published for 2005 and 2007/08.

As with the previous reports, this summary for 2010/11 was commissioned by Dairy Australia on behalf of the Dairy Manufacturers' Sustainability Council (DMSC). The DMSC is a Community of Practice that evolved from the Dairy Manufacturers' Environmental Forum, itself formed in 1998. The continued aim of the DMSC (as it was renamed in 2005) is to assist company members to improve their environmental sustainability. This is achieved by enabling knowledge-sharing on best practice, and by publicly reporting on collective outcomes.

Dairy Australia is the national services body for dairy, both for farmers and for their related manufacturing industry. The role of Dairy Australia is to help farmers adapt to external change and to maintain a profitable and sustainable dairy industry along the supply-chain. In carrying out its duties, Dairy Australia returns a $3 benefit to farmers for every dollar of levy the farmers pay based on milk production[8]. Commissioning and publishing this environmental sustainability report is also part of the support that Dairy Australia provides to the dairy manufacturing industry.

This particular report assesses and communicates the collective environmental performance of the dairy manufacturing industry, as represented by the DMSC-member companies, in 2010/11. Performance is measured against a series of "key performance indicators" (KPIs) that were first established in the DMSC's initial State of the Environment Report for 2005. These KPIs cover key environmental impacts relevant to dairy manufacturing: energy consumption, greenhouse gas emissions, water and chemical use, wastewater discharge, solid waste disposal.

The information disclosed in this report was largely drawn from data gathered as part of a members' engagement program. Respondents to this program were invited to complete an online survey and to participate in follow-up interviews; both undertaken by Net Balance.

A total of eight manufacturing companies contributed environmental performance data for this survey. Five companies reported as single sites and/or on an aggregated corporate basis. The remaining three companies reported across a total of seventeen individual sites. The participating companies and sites are listed on page 9 in the Survey Response section.

Combined, the aggregated data for all companies/sites represented 88% of the milk volume processed in Australia during 2010/11. As not all of the companies had data for all of the KPIs, the percentage of the national milk volume represented is also noted for each individual indicator.

As well as providing raw data, the participating companies provided case studies on individual initiatives to reduce their environmental impact. A selection of these case studies is included in the text of this report.

8 BDA Group (agricultural investment analysts)

Dairy in action

Australian dairy industry

Dairy was Australia's third largest rural industry in 2010/11, after beef and wheat, with a farm gate value for milk of $3.9 B[9]. Dairy manufacturing using this locally supplied milk was also the largest value-added food industry in Australia with an ex-factory production valued at $3.5 B in retail sales for milk and butter (only), plus additional export sales of $2.75 B.

The Australian dairy industry in 2010/11 was based on a collective of 7,400[10] small- to large-scale businesses, including farms. These businesses encompassed a range of both farm and non-farm disciplines, including people working in transport, field services, warehousing, quality assurance, marketing, finance, administration and milk processing. This range of disciplines represented a substantial employment base throughout the dairy value chain (Fig. 1).

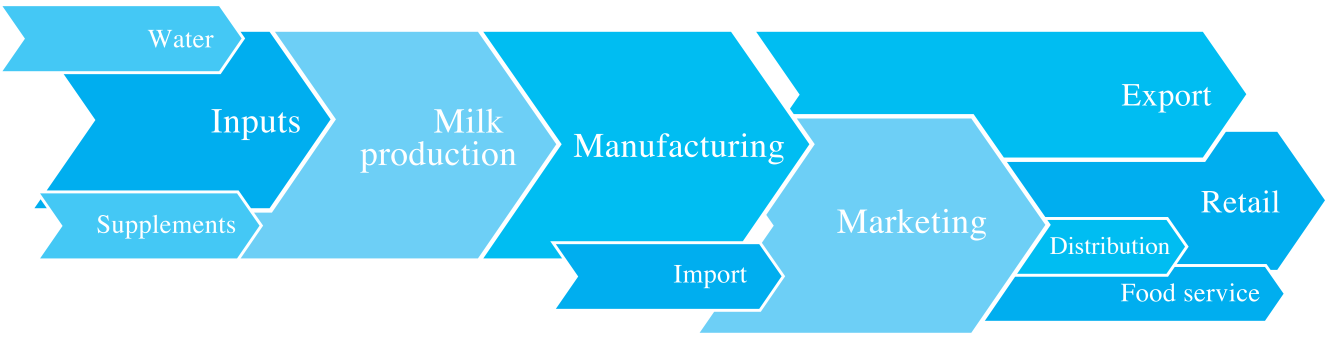


Figure 1 Australian dairy industry value chain, from feed and fertiliser production, through milk supply and processing, to final retail sale

The Australian Bureau of Statistics estimated that in 2006 dairy farming alone supported approximately 22,000 people. Support to farming (via veterinary, animal genetics & nutrition, milking machinery, and contracting services) supported or employed an additional 10,000 people. Dairy manufacturing then employed 16,000 people with a further flow-on effect via employment in relevant research areas such as agriculture, environment, human nutrition, manufacturing processes and food technology[11].

Milk production

Milk production in Australia is concentrated in the temperate zones and is seasonal (especially in the south-east) due to the largely pasture-based nature of the industry. Seasonality means milk volumes peak in October, together with the "spring flush" in grass production, and taper off until late-summer. This seasonal variation in milk supply is offset by long shelf-life dairy products that enable maximum milk utilisation to be extended throughout the year. Seasonality is however less pronounced in Qld, NSW and WA where there is also a more limited production focus on drinking-milk and similar short shelf-life products. As a result, farmers in these states manage their calving and feed systems to ensure more even year-round production.

9 2011, Dairy Australia. Dairy in Focus 2011
10 2011, Dairy Australia, 2011 Dairy People Factfinder
11 2011, Dairy Australia, 2011 Dairy People Factfinder

Operating conditions for most of the dairy industry improved in 2010/11 following several years of extended drought, but this was subject to significant regional variances that still impaired overall production. Very dry growing conditions were experienced in south-west WA over most of the season, whereas most of Qld faced major cyclone and severe flooding events from late 2010 into early 2011. Parts of the NSW coast, plus northern and eastern Vic, also experienced widespread flooding during the financial year. In southern regions, the resultant poorer feed quality and limited cow numbers placed significant constraints on production growth. Overall, Australian milk production in 2010/11 of 9.1 BL represented a marginal decrease of 0.9% (or 80 ML) compared with 2009/10[12] and a 1.3% reduction compared with 2007/08.

Domestic milk sales

Australian milk consumption has steadily shifted over many years from regular to modified milk, including homogenised and reduced or low fat varieties. The long-term trend for full cream white milk is it has continued to lose share in a growing market, settling at 49% of total drinking milk sold in 2010/11. Growth in flavoured milks was up over 5% for the same year.

Dairy manufacturing

As noted above, dairy farming is a well-established industry across the temperate areas of Australia. As a result, there has been little change in the locations of the main dairy manufacturers over many years. The major products manufactured at these largely south-east locations are:

- drinking milk; pasteurised and UHT
- fresh consumer products; yogurts, custards, dairy desserts
- butter
- cheese
- milk-based powders; whole, skim, buttermilk
- specialty ingredients; whey proteins, bioactives.

These dairy foods are a complex mixture of components, are naturally rich in energy and nutrients, and provide at least ten essential nutrients or food groups including:

- protein
- carbohydrate
- vitamins (A, B12, riboflavin)
- minerals (calcium, phosphorus, magnesium, potassium, zinc).

Cheese is consistently the single biggest of these dairy product streams, consuming around one third of Australia's milk production in 2010/11. Drinking-milk by comparison consumed about a quarter of total milk production. More than 40% of total manufactured dairy production continued to be exported, although 97% of drinking milk was consumed in the domestic market. In 2010/11, Australian manufacturers exported an estimated 641,000 t of dairy products[13]. These sales generated an estimated $2.75 B and represented 8% of the internationally traded dairy market[14]. The top three export destinations for this trade, by both volume and value were Japan, China (including Hong Kong and Macau) and Singapore[15].

12 2011, Dairy Australia. Dairy 2011 Situation and Outlook
13 2011, Dairy Australia. Dairy in Focus 2011
14 ibid
15 ibid

Survey response

Survey sample

To evaluate the progress in environmental sustainability within the Australian dairy manufacturing industry, all of the major producers (including non-DMSC members) were invited during 2012 to participate in an online survey. A number of follow-up interviews were also undertaken with a total of eight companies subsequently contributing environmental performance data for 88% of all milk processed in Australia in 2010/11. Five of these companies reported as a single site or as an aggregated corporate entity, with the remaining three companies reporting across multiple sites. The participating companies also provided case studies for a range of initiatives that had either reduced their environmental impacts since 2007/08, or were expected to on completion after 2010/11. These case studies are listed in Table 1.

The Australian dairy manufacturing companies (and sites) that participated in the 2010/11 Sustainability Report were:

Bega
Strathmerton

Cobden
Cororooke
Darnum Park
Dennington
Spreyton
Stanhope
Wynyard
Wagga Wagga

Cobram
Edith Creek
Kiewa
Koroit
Leongatha
Maffra
Rochester

Analysing environmental performance

The survey information and data were provided by companies in good faith, although not all were able to provide a comprehensive data set for all sites and/or metrics. Corporate and individual site data was aggregated and analysed against a series of Key Performance Indicators (KPIs) for water, energy, chemicals, waste and packaging. (A description of the KPIs and the metric used for each is given in Table 2.) Results are given against the percentage of total raw milk processed for each particular KPI to indicate where data sets were less complete.

None of the analysed data was independently assured or audited although some of the raw data for energy and carbon may have been previously audited through appropriate regulatory reporting mechanisms (eg. EEO and NGERs). Some changes in methodology were made from the previous reports for 2005 and 2007/08 but data was cross-checked where possible to ensure that any comparisons were still a true representation. In some instances, data that was inconsistent or potentially inaccurate was excluded and the industry representation as a percentage of milk processed was again adjusted accordingly for that KPI.

A general observation from the survey exercise was that the quality and volume of data collected by individual companies had improved, largely due to Commonwealth and State based regulatory reporting requirements for energy, water and waste (ie. EEO, NGERs and EPA Vic's EREP and WaterMap programs). Evidence for this improvement was that general energy and emissions data could now be allocated to individual categories of product, which allowed better understanding of the complexity within the environmental data for dairy manufacturing.

For the purposes of this report, the range of different dairy products were categorised as falling into one of three classes: fresh dairy (milk, yogurt, deserts), dairy powders, or cheese. This product mix constantly changes based on domestic and international market demands and on available milk supply. The relative mix of dairy products for the three reporting periods to date is shown in Fig. 2.

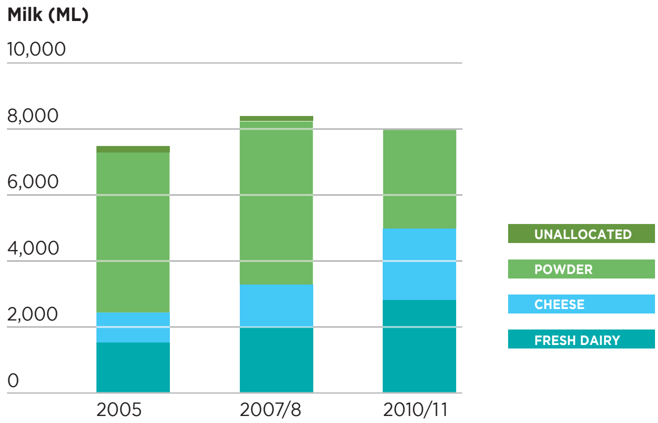


Figure 2 Allocation of milk (as ML raw milk processed) to each of three product categories reported by Australian dairy manufacturing companies for 2005, 2007/08 and 2010/11

Total milk production for 2010/11, and the proportion processed by companies who participated in this report, is shown in Fig. 3. Both total production and the percentage represented by the participating companies showed a small decrease compared with 2007/08. This relatively flat production and the much bigger decline since 2005 was attributed to the combined impact of drought and a reduction in demand for dairy products influenced by the financial crisis.

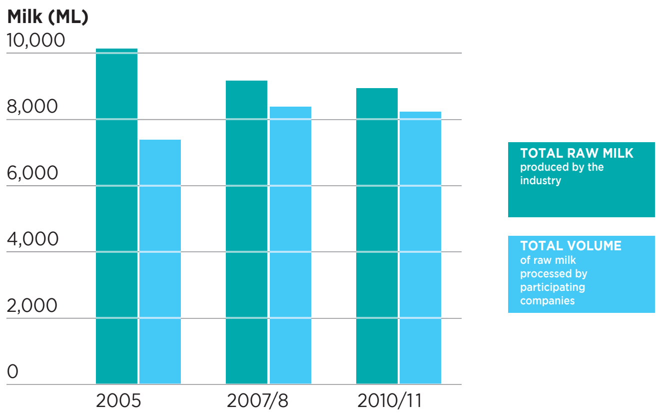


Figure 3 Total raw milk production in Australia and the relative volume(s) of milk processed by dairy manufacturing companies reporting for 2005, 2007/08 and 2010/11

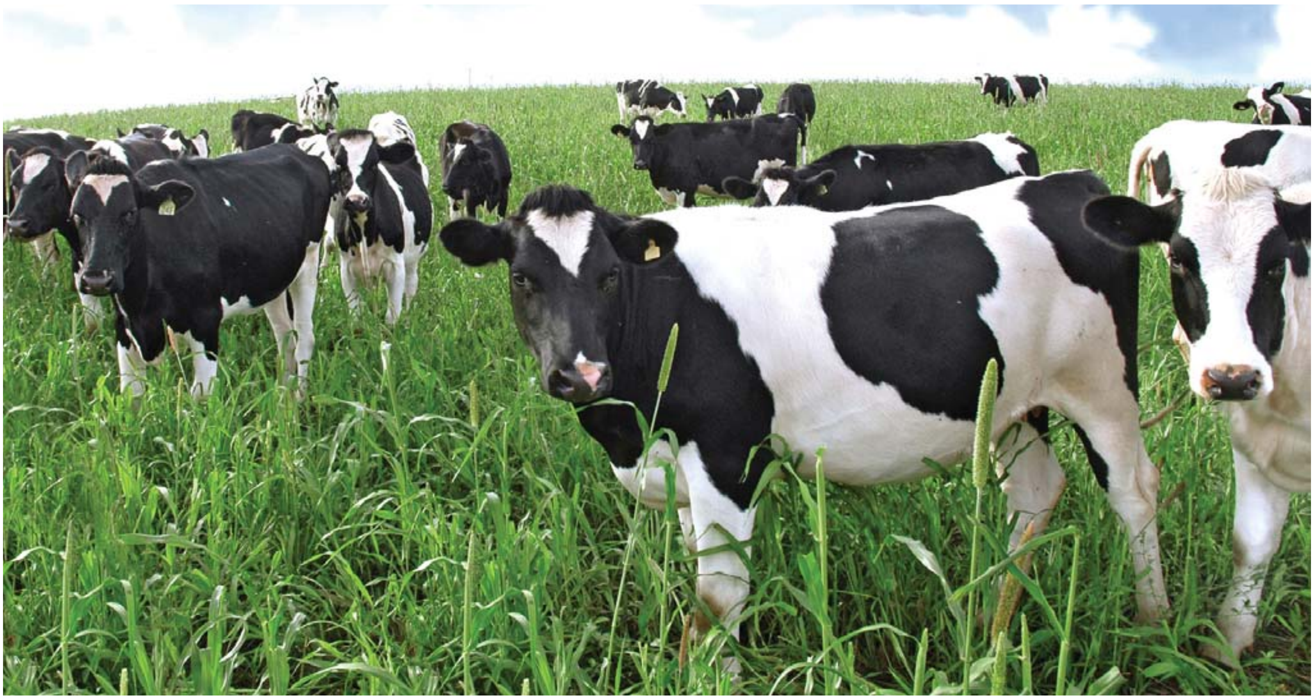
Case studies

All of the dairy manufacturers participating in the 2010/11 report have been involved in implementing projects to improve their operating efficiency, reduce resource use, improve environmental performance, and/or decrease costs. A number of case studies are included in this report to illustrate the breadth of these activities and related investment, and where detail is available to also illustrate the gains made in environmental performance (Table 1).

KPI	Company/site	Achievements (annual unless otherwise specified)	Page
Water	Lion @ Chelsea	29 ML water reduction	16
Energy	Tatura*	>5% energy efficiency in powder drying	18
Energy	Bega Cheese* @ Bega	5089 GJ savings from refrigeration	20
Energy	Fonterra	Reduction in diesel fuel use for milk transport	21
Emissions	MG* @ Leongatha	11000 t CO_2-e abatement using biogas energy	23
Emissions	Fonterra	16000 t CO_2-e abatement from natural gas-fired boilers	24
Waste	Warnambool	306 t solid waste diverted from landfill	26
Wastewater	Parmalat*	44% reduction in discharged BOD	28
Compliance	Parmalat @ Nambour	Reduction in odour from on-site wastewater treatment	28
Chemicals	MG* @ Koroit	95% recycling of used caustic	30

* Annual outcomes projected for projects that were installed or commissioned (but not completed) by 2010/11

Table 1 Summary of individual environmental case studies for dairy manufacturing companies presented in detail in the Australian industry sustainability report for 2010/11



Key Performance Indicators

Applying KPIs to Australian dairy manufacturing

A range of environmental sustainability KPIs were used to provide a snapshot of the performance of the Australian dairy manufacturing industry during 2010/11. A description of each indicator is given in Table 2; qualitatively in terms of its relevance to dairy manufacturing and quantitatively in terms of the metric used.

KPI	Application in dairy manufacturing
Water	Fresh water is used to clean all milk transport and processing equipment, to ensure the highest levels of food safety, and for general processing needs such as heating and cooling. Reported as total ML consumed and as L freshwater / L raw milk processed.
Energy	Energy is used to power dairy refrigeration, plant air conditioning, machinery (pumps, motors, fans) and for general plant operation (eg. lighting). Reported as total GJ used and GJ / ML raw milk processed.
Greenhouse gas	Greenhouse gases are emitted directly during the combustion of fossil fuels eg. for power or steam generation and during transport. Emissions also occur indirectly through the consumption of electricity and third party-supplied steam. Reported as total t CO_2-e emitted and as CO_2-e / ML raw milk processed. Conversion factors used were from the Department of Climate Change (National Greenhouse Accounts factors, 2008) taking into account the fuel source for electricity supplied in each State.
Packaging	Packaging helps maintain the quality of dairy products throughout the supply chain, through its role in food safety and damage prevention. No direct metric was used in this report.
Solid waste / by-products	Dairy manufacturing generates a mix of organic and solid wastes. The majority of the solid wastes are from product packaging or routine plant maintenance and generally consist of plastic, metal, cardboard, wood and paper. Organic waste comes from a number of different sources but is typically reject dairy product or wastewater treatment sludge. The majority of organic wastes have the potential for reuse as compost or feedstock for animals. Reported as t solid waste generated / ML raw milk processed.
Wastewater	All dairy factories produce wastewater as a result of daily cleaning and flushing of processing equipment. This wastewater generally consists of product residue as well as cleaning chemicals and may be high in fat and salt. Methods of waste treatment used on-site include dissolved air flotation (DAF) to remove solids and biological treatment to reduce the organic loading (BOD) before discharge. Many factories discharge to sewer or irrigate directly to land with minimal treatment, although discharge of all wastewater is closely monitored and regulated under local EPA and water authority trade waste agreements. Reported as total ML wastewater generated and as L wastewater / L raw milk processed.
Chemicals	Dairy manufacturers use a wide range of chemicals to clean processing equipment and during water and wastewater treatment and to maintain boilers and cooling towers. The most commonly used cleaning chemicals are sodium hydroxide (caustic soda), sodium hypochlorite (bleach), nitric acid and phosphoric acid. Reported as total chemical use (combined) / ML raw milk processed.

Table 2 Description of KPIs used to assess environmental sustainability performance within the Australian dairy manufacturing industry during 2010/11

Factors influencing KPIs

Seasonal conditions

Operating conditions for Australian dairy farming improved during 2010/11 on the cessation of prolonged drought conditions across most of the country. Significant rainfall did however create production difficulties in some areas due to water-logged pastures and related herd health problems prevented the expected increase in milk supply.

Continued limitations in milk supply as a result of the above continued to limit the relative efficiency at which fixed volume processing plants could operate (although this relationship between plant throughput and changes in KPI outcomes was not quantified for this report).

Product mix

The product mix generated by the Australian dairy manufacturing industry has continued to change with a steady increase in the proportion of fresh dairy and cheese produced since 2005, with a corresponding reduction in dairy powders (Fig. 2). This change in product mix is significant when measuring environmental performance as overall resource efficiency decreases, on a per litre of milk processed basis, as the relative production of cheese increases. The individual resource efficiency of powder production also decreases as the percentage utilisation of the required drying equipment falls below capacity [data not shown].

Although the observed changes in product mix were likely to have significantly influenced the (negative) KPIs recorded for 2010/11, this can neither be quantified nor stated definitively with the data available. The relative environmental implications for each product category can however be broadly categorised as shown in Figure 4.

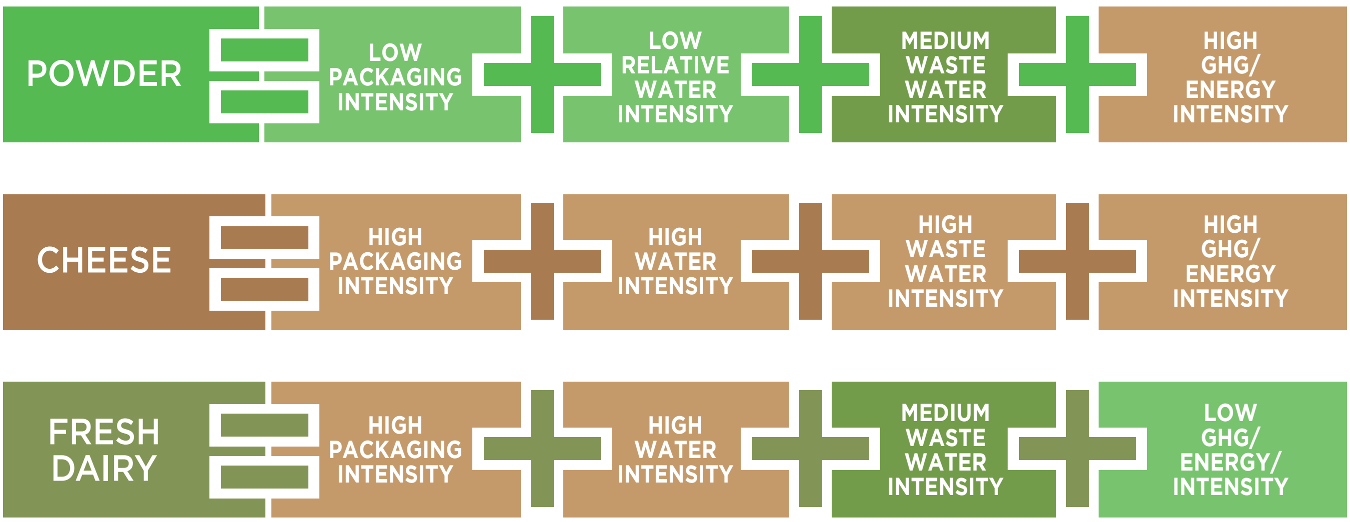


Figure 4 Comparison of the relative environmental impacts from the three main product categories produced by the Australian dairy manufacturing industry

KPI highlights for 2010/11

water

- Sites surveyed consumed 13,967 ML of fresh water.
- Comparison with 2007/08 showed increase in fresh water consumption from 1.54 L fresh water / L raw milk processed to 1.75 L fresh water / L raw milk processed.

energy

- Sites surveyed consumed 10.7 million GJ of electricity and thermal energy combined.
- Comparison with 2007/08 showed increase of 41 GJ / ML raw milk processed.
- Energy uses were 63% thermal, 24% electricity, 13% transport fuel.

ghg

Total greenhouse gas (GHG) emissions excluding transport ie. from electricity and thermal energy, were estimated at 1,453 kt CO_2-e total or 179 t CO_2-e / ML raw milk processed.

packaging

100% of companies surveyed were signatories to the National Packaging Covenant, a voluntary scheme to reduce packaging.

solid waste

- Average solid waste production decreased from 5.8 t / ML raw milk in 2007/08 to 4.3 t / ML of raw milk in 2010/11.
- 30% of all solid waste was recycled.

waste water

- Sites surveyed generated 13,200 ML of wastewater
- Wastewater generation increased from 1.7 L wastewater / L raw milk processed in 2007/08 to 1.9 L wastewater / L raw milk processed in 2010/11.

chemicals

Average of 1.2 t chemicals (combined) were used / ML raw milk processed in 2010/11, compared with 2.0 t chemicals (combined) / ML raw milk processed in 2007-08.

water

Sites surveyed consumed 13,967 ML of fresh water

Water consumption increased by 1,000 ML compared with 2007/08 or from 1.54 L fresh water / L raw milk processed to 1.75 L fresh water consumed / L raw milk processed

Water consumption

During 2010/11, the companies participating in this report consumed 13,967 ML of fresh water whilst processing 88% of all raw milk handled nationally. The majority of this water was sourced from town supply with recycled water representing approximately 1% of the total. This rate of water use was an increase of 12% compared with 2007/08 or an increase from 1.54 L[16] fresh water / L raw milk processed to 1.75 L fresh water used / L raw milk processed (Fig. 5).

Water use in dairy manufacture

Even allowing for the impact of product mix on the final volume of water used, individual dairy processing plants still use substantial volumes of water irrespective of production, for equipment cleaning, cooling towers, boilers and other processes.

Cleaning is the single largest water-consuming process. The volumes consumed are typically not proportional to volume of milk processed meaning that water consumption becomes less efficient as processing volumes fall. This is because the size of equipment stays the same but operation runs become shorter between each cleaning cycle.

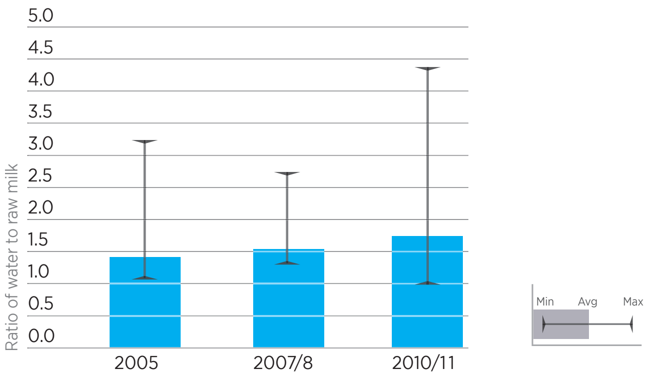


Figure 5 Water-use intensity (L water used / L milk processed) in Australian dairy manufacturing during 2005, 2007/08, and 2010/11

Different dairy manufacturing processes consume varying quantities of water and dairy powder operations consume significantly less water than for those for cheese production (Fig. 6). The significantly higher volume of cheese production in 2010/11, as a proportion of all milk processed (Fig. 2), will consequently have influenced the observed 12% increase in total water consumption, but it is not known by how much.

[16] Incorrectly reported in 2007/08 report as 1.34 L

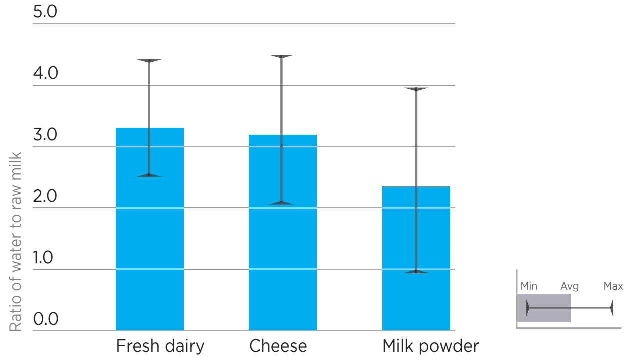


Figure 6 Water-use intensity for the three product categories (fresh dairy, cheese, and dairy powder) produced by the Australian dairy manufacturing industry in 2010/11

CASE STUDY

water use efficiency

Lion (National Foods):
Water saving initiatives developed through EPA Victoria's EREP and WaterMAP programs

Lion's Chelsea plant in Melbourne was able to identify a series of water reduction opportunities in 2009 through its participation in EPA Victoria's Environment and Resource Efficiency Plan (EREP) program. Many opportunities were implemented almost immediately leading to a saving of 29 ML of fresh water annually.

Initiatives implemented included moving to a six-day production schedule, which eliminated one clean-in-place (CIP) wash a week (saving 6.76 ML each year), installing improved sprays on carton fillers (saving 10 ML per year), and reducing the amount of water used to flush milk pasteurisers during cleaning whilst still maintaining required levels of hygiene.

These and other initiatives were included in the site's Water Management Action Plan (WaterMAP) a sister program mandated by the Victorian government for all companies using more than 100ML water annually.

energy

Sites surveyed consumed 10.7 million GJ of electricity and thermal energy combined

Comparison with 2007/08 showed increase of 41 GJ / ML raw milk processed

Energy use in dairy manufacture

The Australian dairy manufacturing industry has previously improved its energy efficiency, in some cases by as much as a 50% reduction in energy intensity over a 20 year period[17]. It is likely that the continuing focus on energy since then, including via the subsequent introduction of legislated NGERS and EEO reporting have led to better data monitoring. Increased monitoring can be evidenced by the continued greater industry representation for the energy intensity KPI in 2010/11 compared with 2005 (Fig. 7).

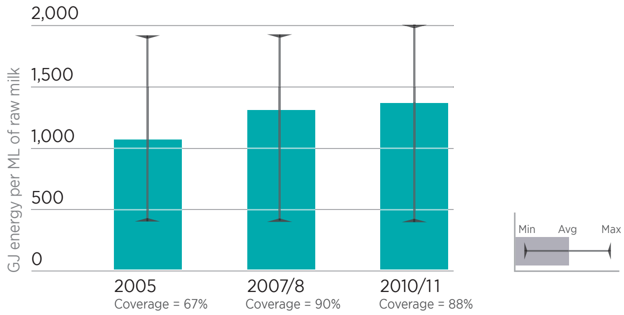


Figure 7 Energy intensity in the Australian dairy manufacturing industry during 2005, 2007/08 and 2010/11

Actual energy use in dairy factories is dependent on the types of products manufactured. Dairy factories producing drinking milk use energy for heating and pasteurisation, cooling and refrigeration, lighting, air conditioning, pumping, and the operation of processing and auxiliary equipment. Factories producing concentrated dairy products such as butter, cheese or powders require additional energy, variously for churning, pressing, separating, concentrating, evaporating and/or drying. This additional energy use increases the relative energy-use intensity / ML raw milk processed.

Of the three dairy product categories reported in 2010/11, dairy powder represented the majority (62%) of total energy consumed (Fig. 8). This predominance of powder production was consistent with trends observed since 2003/04 [data not shown] because production of powder requires more energy (including to evaporate water) compared with liquid milk processing (included under fresh dairy). However, the drop in powder production as a percentage of the total product mix in 2010/11 (Fig. 2) will have further skewed the relative energy intensity, as energy intensity increases if powder drying equipment is run below capacity or for shorter durations. The perishable nature of milk however precludes its being stored for prolonged periods of time until optimal volumes are available for the most efficient operation of drying equipment.

[17] Lunde, S., Feitz, A., Jones, M., Dennien, G. and Morian, M. 2003, Evaluation of the environmental performance of the Australian dairy processing industry using life cycle assessment, Dairy Research Development Corporation

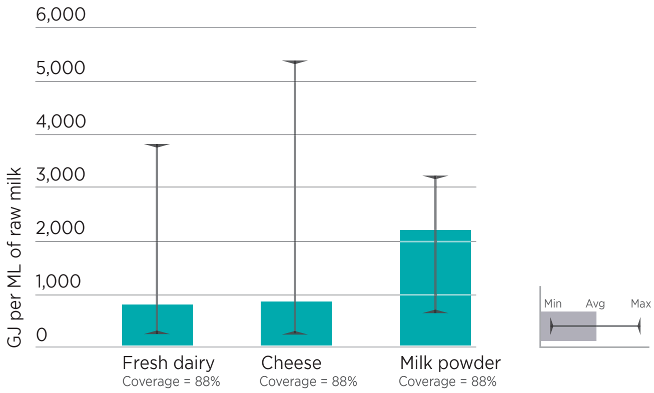


Figure 8 Energy use intensity in 2010/11 for the three dairy product categories (fresh dairy, cheese, dairy powders) produced by the Australian dairy manufacturing industry

CASE STUDY

energy use efficiency

Tatura: "Meterman" project to improve energy efficiency in powder dryers

In 2010, Tatura Milk Industries (TMI) developed a project to assess the benefit of using real time energy data to improve operational efficiency in their powder dryers. Real time monitoring had previously been adopted elsewhere but with mixed results.

Using a major investment of $600k of Government and industry funding, including from the Geoffrey Gardiner Foundation, technicians installed two dozen meters on one dryer, to capture data on air and liquid flows, humidity, steam, and associated electricity consumption over an 18 month period.

Throughout 2010/11, a small group of employees developed a program for step-by-step improvement in the dryer operation as data became available. This process also revealed that highly experienced dryer operators already had different (and entrenched) ways of managing the dryer performance. A key element of the TMI approach was anticipating this outcome and engaging a consultant to assist with people-related aspects of the project, ensuring greater implementation / behavioural change.

Different operating options were tested and the most effective ones used in developing a set of procedures that were subsequently accepted by all of the individual operators as moving towards both consistent and optimum (energy efficient) performance. It was projected that on completion of the project after 2010/11 improvements in productivity would be >5%. Tatura Milk Industries is now looking into how these lessons can be applied to its other dryers, to further improve productivity and related energy savings.

Energy consumption

Combined electrical and thermal energy use by participating companies in 2010/11 was estimated to be 10.7 million GJ whilst processing 88% of national milk production. (The split between thermal and electrical energy, and transport fuel use, is shown in Fig. 9.) This equates to an energy usage of 1,341 GJ / ML raw milk processed or an increase of 41 GJ / ML milk processed compared with 2007/08 when energy usage was 1,300 GJ / ML raw milk processed.

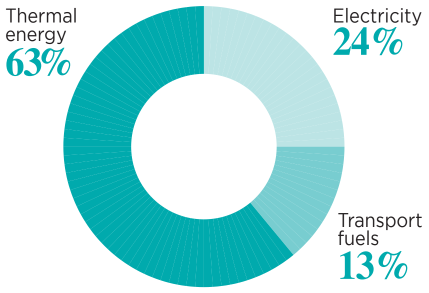


Figure 9 Distribution of energy use across thermal, electrical and transportation applications by the Australian dairy manufacturing industry in 2010/11

Both electricity and thermal energy were generated externally and on-site, typically using fossil fuels including coal, oil, natural gas and LPG, whilst a small number of plants supplemented their energy supply using biogas. The choice of energy source depended both on the required application and the geographical location with natural gas and grid electricity being the two main sources of energy reported by dairy manufacturers in 2010/11 (Fig. 10).

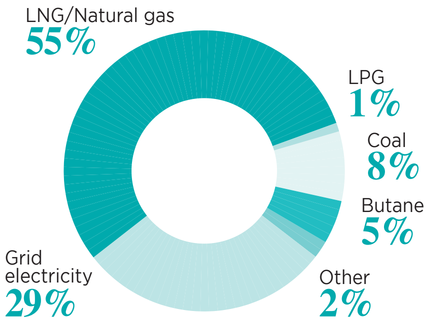


Figure 10 Breakdown of energy sources used by Australian dairy manufacturers during 2010/11

It should be noted that whilst natural gas produces fewer GHG emissions and represents a better value for money option, it is not available in all regional areas. Similarly, for dairy manufacturers operating in Victoria, significant exploration is underway on options to reduce dependence on (brown) coal based electricity, given its high GHG intensity. Existing energy contracts and concessional arrangements for large users such as dairy companies are however limiting the pace of change in this area.

In the above context, increases in the price of energy continued to impact the dairy industry.

The external reporting requirements mandated in legislation such as NGERs and EEO also resulted in energy consumption being more closely measured and monitored by the manufacturers. The impact of the Clean Energy legislation, incorporating carbon pricing, is not however included in this report covering 2010/11 although the lead-up to the introduction of this legislation did provide financial incentives for changes in energy consumption behaviour and adoption of technology.

CASE STUDY

energy use efficiency

Bega Cheese: Refrigeration and lighting review

Industrial refrigeration plants are an essential part of the dairy supply chain and substantial users of energy. The amount of energy consumed by refrigeration can often constitute the majority of electricity use at an individual dairy operation.

In recognition of the growing need to reduce power consumption within the industrial refrigeration sector as a whole, including dairy, the NSW State government's Office of Environment and Heritage (OEH) appointed industrial refrigeration specialist Minus40 to help sites identify energy saving opportunities and to develop (internal) business cases for implementation.

Bega Cheese operates a number of refrigeration plants at its processing and packaging facilities in Bega, NSW. These facilities are mainly used to process milk, whey and cheese products, as well as for storage and maturation of bulk and retail cheese products. In December 2010 Bega Cheese got involved with the Energy Saver Industrial Refrigeration project set up by the NSW Government.

Six energy saving opportunities were selected for implementation based on Bega Cheese's business drivers of cost reduction, greenhouse gas abatement, improved plant reliability, and increased capacity. Under the OEH-subsidised program, Bega Cheese reviewed and developed the individual business case for each project and subsequently applied for a grant covering $258,000 worth of projects (or 33% of the total capital cost) under the Federal Government's Clean Technology Investment Program. This program of work included a lighting project that was developed to replace high bay lights with more energy efficient LEDs in one of the cool rooms, with the added advantage of reducing heat load, further improving refrigeration efficiency.

These six refrigeration-related projects were projected to save 5,193 GJ of energy (or 1,174 t CO_2-e), with the lighting changes saving an additional 774 GJ (230 t CO_2-e). Findings from both the refrigeration and related lighting studies were to be rolled out to other Bega Cheese facilities in Victoria (subject to grant approval after 2010/11).

Transport fuels

Outside of the energy used during dairy manufacturing, milk transport from farm to factory is a significant user, as well as being an essential element within the dairy supply chain. Environmental impacts are generally associated with the emissions from fuel used for both transportation and related refrigeration. In 2010/11, diesel fuel represented the largest component of transport energy in the dairy industry (Fig. 11).

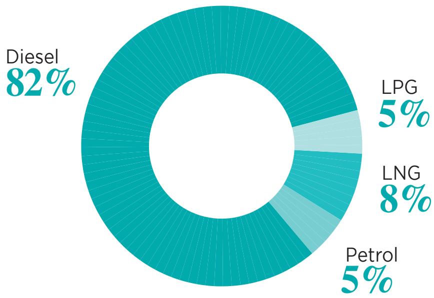


Figure 11 Breakdown of transport energy by fuel type as used by Australian dairy manufacturing companies in 2010/11

CASE STUDY

energy use efficiency

Fonterra: Measures to reduce environmental impacts from diesel fuel use during milk transport

Milk transport is an essential part of the dairy supply chain. Environmental impact from this transport can include waste water from daily rinsing of individual milk tankers but is more generally associated with diesel fuel use.

Fonterra's farm-milk collection schedule is optimised for various factors, including fuel use. It uses a modern transport fleet that conforms to emissions standards for nitrous oxide and particulates. Half of this fleet is comprised of B-double tankers which use less fuel per litre of milk transported than single tankers, further improving the fuel efficiency per litre of milk transported.

Each regionally located group of tankers has a team of dedicated maintenance technicians who regularly service the prime movers and check tyre pressures daily. Diesel fuel use is then tracked weekly for each individual truck with outcomes compared against industry benchmarks. The individual prime movers are replaced regularly in response to both this fuel tracking data as well as total distance travelled.

Fonterra has moved to specify that all new trucks have more fuel-efficient engines. These specifications include automatic transmissions to allow engines to operate under optimal conditions for longer, plus post-construction modification with dosing equipment for a Selective Catalytic Reduction (SCR) exhaust additive. This additive reduces nitrous oxide and particulate emissions in excess of the emissions standards for "Euro V" diesel engines. The extra cost of this additive is offset by a 3% fuel saving, also reducing the carbon footprint for transport.

As a result of the above modifications, and compared with a 10 year old truck, Fonterra's modified Euro V vehicles now generate 80% less particulates (soot), 60% less nitrous oxide, 31% less hydrocarbons, and 29% less carbon monoxide.

ghg

Total greenhouse gas (GHG) emissions from electricity and thermal energy (ie. excluding transport) estimated at 1.45 Mt CO_2-e

GHG intensity was 179 t CO_2-e / ML raw milk processed

Sources of emissions in the Australian dairy industry

Australian agriculture accounts for about 17% of national GHG emissions. The dairy industry contributes 10% of agricultural emissions, or less than 2% of the national total.

There are a range of pre- and post-farm gate activities that contribute to the dairy industry's total carbon footprint. In addition to carbon counted as "on-farm" due to animal husbandry and feed production, dairy farms also emit significant amounts of CO_2-e through direct use of fossil fuels and electricity. By comparison, dairy manufacturing represents a relatively small component of the total carbon emissions from the dairy supply chain.

Dairy industry emissions

The carbon footprint for Australian farmgate milk was calculated to be 1.11 kg CO_2-e / kg fat and protein corrected milk (FPCM) for 2010/11. This was one of the lowest dairy footprints internationally and comparable with countries with the most advanced dairying industries [data not shown].

The total quantity of GHG emitted post-farmgate was estimated by participants in this 2010/11 survey to be 1,453 kt CO_2-e based on 88% industry representation. These emissions consisted of Scope 1 contributions from direct energy use of 607 kt CO_2-e and Scope 2 contributions from indirect energy use (typically purchased electricity) of 846 kt CO_2-e (Fig. 12). These combined emissions were equivalent to an intensity of 0.18 kg CO_2-e / L milk processed. (Note that this post-farmgate figure was calculated on a non-FPCM basis and used a less rigorous accounting methodology than for farmgate milk.)

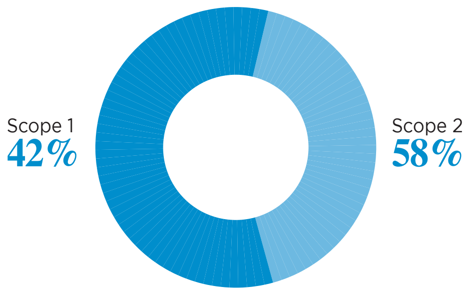


Figure 12 Proportion of emissions from Scope 1 and Scope 2 sources for the Australian dairy manufacturing industry in 2010/11

This level of emissions intensity was an increase from previous DMSC sustainability reports (Fig. 13) but was consistent with the increase in energy intensity also reported.

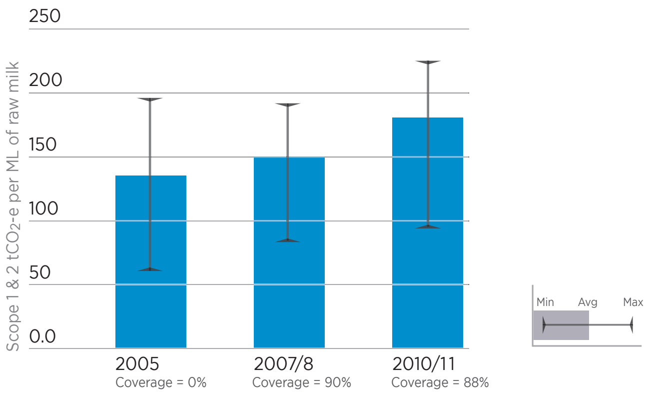


Figure 13 Emissions intensity in Australian dairy manufacturing during 2005, 2007/08 and 2010/11

The majority of emissions from dairy manufacturing are due to energy consumed through electricity and on-site energy use, followed by transport. The amount of energy used and therefore the carbon emissions generated depends on the mix of dairy products produced (Fig. 14).

CASE STUDY

emissions

MG: Renewable power generation using methane

Murray Goulburn Co-operative Co. Ltd (MG) invested in bioenergy and waste water treatment upgrades at its Leongatha site to help minimise environmental impact and save money.

In 2009, MG spent $20 million on upgrading the existing Leongatha waste water treatment plant so that all liquid waste from the site's dairy manufacturing process could be turned into clean, salty water suitable for discharging safely into the ocean.

Part of the upgrade to this plant included anaerobic digestion to reduce the organic and nitrogen load in the final wastewater. This generated approximately 9,000m^3 of biogas in the process.

In mid-2010, MG installed and commissioned two biogas engines with a combined electricity generating capacity of 760 kW with the help of Sustainability Victoria (who provided $140,000 of funding) and power supply company SP Ausnet.

The biogas engines have the combined capacity to generate 5000 MWh per year and to consume 99% of on-site methane and are projected to reduce electricity demand from the grid by 9%.

Final commissioning after 2010/11 was expected to reduce MG's emissions by 11,000 tonnes of CO_2-e annually.

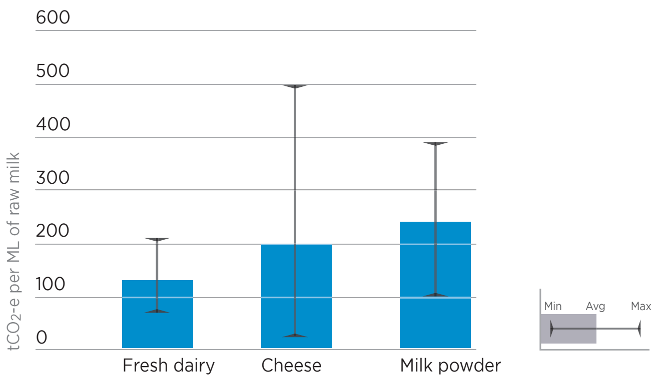


Figure 14 Emissions intensity in 2010/11 for the three dairy product categories (fresh dairy, cheese, and dairy powders) produced by the Australian dairy manufacturing industry

Government legislation

The largest dairy manufacturers in Australia are currently participating under the Australian Government's legislation for the EEO and NGERs programs. In the absence of certainty on the outcomes of future legislation, the industry remains engaged in a range of emission reduction initiatives under these Acts, including investing in research to improve manufacturing as well as farming practices, carbon sequestration on farms, and implementation of energy efficiency projects.

CASE STUDY

emissions

Fonterra: Replacement of cooling towers and coal-fired boilers

Carbon abatement is a significant issue for the dairy industry. Fonterra, like other DMSC companies, uses purpose-designed programs to assess their opportunities for such abatement. These assessment programs are designed in a structured way to identify all possible actions including those involving modifying activities or adapting behaviours, as well as the investment of capital.

Fonterra recognised that driving energy efficiency improvements in its integral site infrastructure could yield significant carbon as well as energy savings. In 2010/11, Fonterra replaced cooling towers at two sites, saving electricity and associated scope 2 emissions and in the same year replaced coal-fired boilers with gas-fuelled boilers at another site, saving 16,000 t of Scope 1 emissions annually. The compressed air systems were also audited across both this and a number of other sites with updated maintenance procedures subsequently developed to ensure that infrastructure systems that operate on a 24/7 basis are as efficient as possible.

solid waste

Surveyed manufacturers averaged 4.3 t of solid waste / ML of raw milk processed

Approximately 30% of solid waste was recycled

A significant proportion of the solid waste generated by Australian dairy manufacturing companies consists of general packaging. However, approximately 54% of all waste reporting to landfill in 2010/11 was classified as general or mixed waste without being further identified (Fig. 15). This proportion of un-classified waste was a significant reduction on 2007/08 where general waste was classified as 97% of the volume reporting to landfill. An increase in identification for specific waste types is indicative of improvement in waste segregation and recycling.

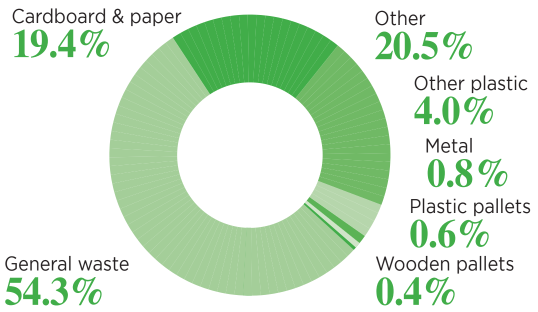


Figure 15 Breakdown of waste types reporting to landfill from Australian dairy manufacturers in 2010/11

In 2010/11, it was estimated that the surveyed dairy manufacturers generated a total of 21,314 t of solid waste during processing of 62% of national milk production, with 6,931 t of this total being diverted from landfill. (The final disposal options for all solid waste is shown in Fig. 16.)

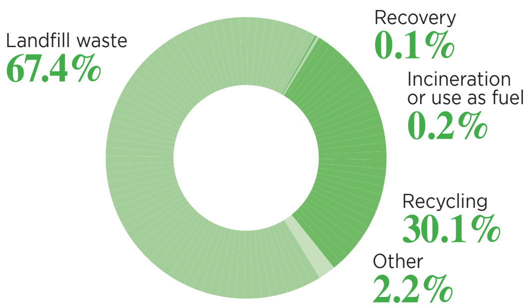


Figure 16 Disposal of solid waste from Australian dairy manufacturing in 2010/11

The significant increase in the cost of landfill levies since 2007/08 was cited as being successful in driving behaviour change with the intensity of solid waste reporting to landfill from dairy manufacturers dropping to 3 t waste to landfill / ML raw milk processed (Fig. 17).

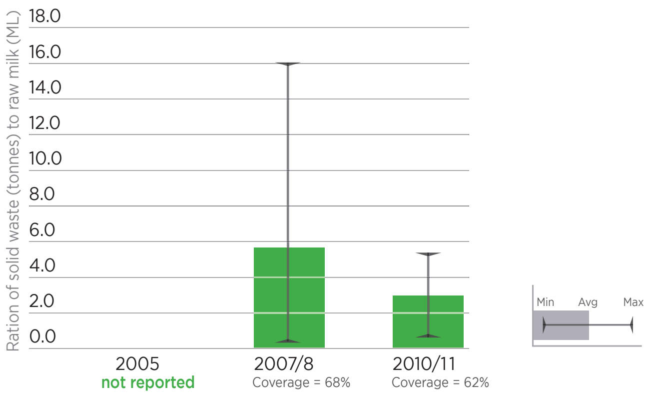


Figure 17 Change in intensity of solid waste reporting to landfill for Australian dairy manufacturers in 2007/08 and 2010/11

CASE STUDY

solid waste

Warnambool: Reduction of solid waste to landfill

During the period covered by the DMSC Sustainability Report for 2007/08, Warrnambool Cheese & Butter (WCB) was capturing cardboard packaging from its cheese plant for recycling but with most other solid wastes going to landfill. As landfill costs increased it was increasingly recognised by the company that these wastes included plastics and paper as well as additional cardboard that could also be recycled.

A series of skip bin audits was followed by a five year rolling programme of installing recycling cages across the company, if both recyclable wastes and a recycling/collection vendor could be identified. In the first year of this program, WCB diverted 65 t of solid waste from landfill and in 2010/2011 was diverting 306 t for the year at a saving of approximately $145k in annual landfill costs.

waste water

Sites surveyed generated 13,200 ML of wastewater in 2010/11

Total wastewater was reduced by 700 ML from 2007/08 but intensity increased from 1.7 to 1.9 L wastewater / L raw milk processed

Nearly 90% of wastewater was used to irrigate local farm land

The participating dairy manufacturing sites generated a total of 13,200 ML of wastewater in 2010/11 after processing 88% of the national milk volume. This data reflects a 5% reduction in wastewater overall, down from 13,900 ML in 2007/08. Despite this reduction, the intensity of wastewater to raw milk processed increased from 1.7 L wastewater generated / L raw milk processed to 1.9 L wastewater generated / L raw milk processed (Fig. 18).

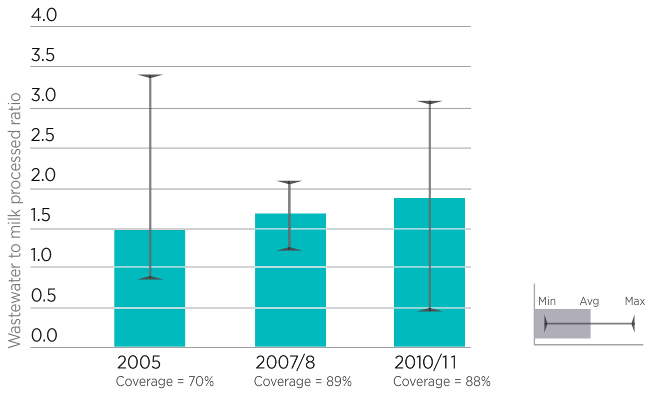


Figure 18 Intensity for wastewater generation in the Australian dairy manufacturing industry for 2005, 2007/08 and 2010/11

As also noted with regards to fresh water consumption, wastewater intensity does not typically fall proportionally to a reduction in milk processed. Instead, wastewater volumes would be expected to be flat (in the absence of wastewater efficiency improvements). For comparative purposes, the wastewater intensity by product category is shown in Fig. 19.

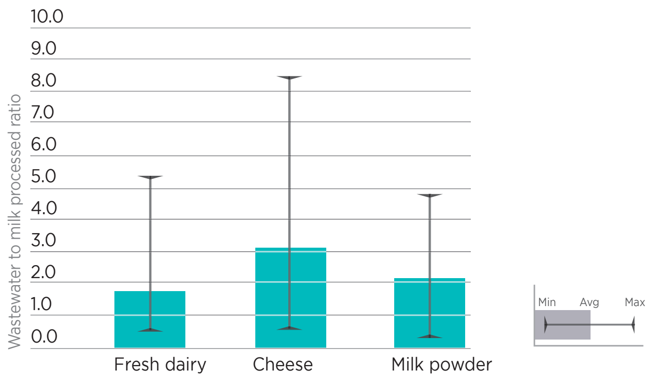


Figure 19 Intensity of wastewater generation in 2010/11 for the three product categories (fresh dairy, cheese and dairy powders) produced by the Australian dairy manufacturing industry

CASE STUDY

wastewater

Parmalat: milk waste reduction at Rowville

In 2007, Parmalat's Rowville factory in Melbourne began a multi-year project to reduce the amount of milk lost during production and cleaning. Detailed analysis of milk losses around the plant were followed by the development of a new daily production schedule to minimise the number of product changeovers required during each processing and filling run.

Since the project began, the volume of milk rinsed into the drains during cleaning has been reduced by 45% without changing the hygienic integrity of the plant. This reduction was projected to total 2.7 ML of milk during calendar 2011, equivalent to 100 farm-milk collection tankers, and a saving to the company of $1.3M.

In addition to the recovered milk value, the reduction in milk rinsed to drain was projected to reduce the Biological Oxygen Demand (BOD) in factory effluent by 44% or 288,000 kg. Extrapolated across calendar year 2011 this represented a potential saving of $226k in avoided waste treatment charges for a combined project saving of >$1.5M.

The parallel introduction of a range of Continuous Improvement tools (eg. Structured Problem Solving, Kaizen Events and Visual Workplace) enabled all employees to be engaged in the implementation of the various parts of this project and will now be used to build upon this foundation for future improved performance/resource reduction.

CASE STUDY

environmental compliance

Parmalat: Installation of new effluent recovery pump at Nambour

Parmalat's Nambour plant has been operating since 1952 and has historically sent its wastewater to sewer for treatment. The central Sunshine Coast area where the local municipal treatment plant is situated has experienced significant residential and tourism development. This combined development has increased the domestic loading on the treatment plant, requiring industrial wastewater from Nambour to be pre-treated on site.

In response to the potential over-loading of the local municipal treatment plant, the Nambour dairy operation installed a dissolved air flotation (DAF) system in 2008 to pre-treat its wastewater. Most of the contained solids were floated out of the waste to form an 'effluent sludge', leaving relatively clean wastewater to go to sewer.

The sludge from the DAF system was initially stored on site before removal by contractor for separate treatment and re-use as an organic fertiliser. The vacuuming process used to transfer the sludge into the transport vehicle was found to cause too much mixing resulting in occasional odour release (hydrogen sulphide) and a nuisance to neighbouring residents. In 2010/11, and in order to address the breach of environmental compliance caused by these nuisance odours, the site maintenance team devised a plan to re-engineer the storage pit with a sloping floor and sump for use during waste transfer. Commissioning of the system was expected to be completed during 2011 with a specially designed centrifugal pump that would reduce disturbance during transfer and lower the occurrence of nuisance odour.

chemicals

Average of 1.2 t chemicals / ML raw milk processed in 2010/11

During 2010/11, the Australian dairy manufacturing industry (based on 59% of the national milk volume processed) consumed 9,656 t of six different chemicals. These six chemicals were sodium hydroxide (NaOH), potassium hydroxide (KOH), nitric acid (HNO_3), phosphoric acid (H_3PO_4), sulphuric acid (H_2SO_4), and sodium hypochlorite (NaOCl). Of the six chemicals, sodium hydroxide was the most commonly used followed by nitric acid, and all were largely used for cleaning in the dairy factories.

Total chemical consumption for 2010/11 equated to an intensity of 1.2 t of chemicals / ML of raw milk processed. This intensity was a significant reduction from the ratio reported in 2007/08 (although it should be noted that the results could be skewed by the smaller sample size as coverage in 2007/08 reflected 80% of the industry on a raw milk production basis but only 59% in 2010/11; Fig. 20).

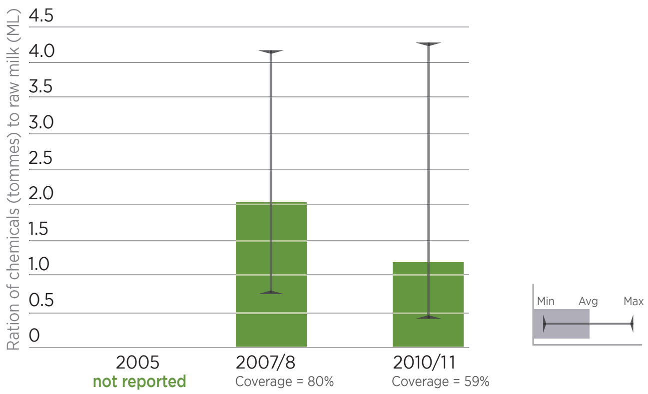


Figure 20 Chemical-use intensity in the Australian dairy manufacturing industry for 2005, 2007/08 and 2010/11

On a product-related basis, the chemical use to milk ratio increased for fresh milk and cheese, but decreased for powder between 2007/08 and 2010/11 [data not shown]. On an absolute basis, cheese continued to represent the highest use of chemicals per ML of raw milk processed (Fig. 21).

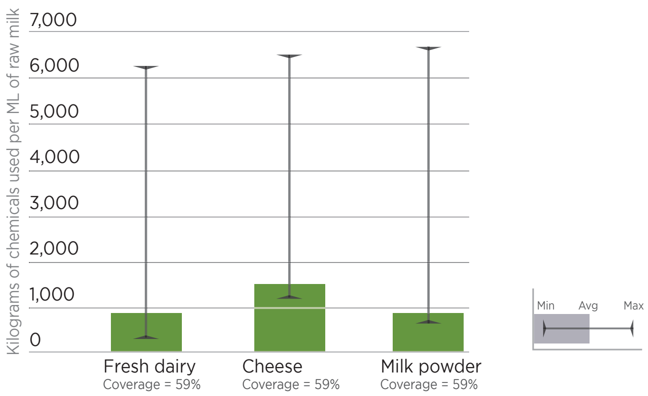


Figure 21 Chemical-use intensity in 2010/11 for the three dairy product categories (fresh dairy, cheese, and dairy powders) produced by the Australian dairy manufacturing industry

CASE STUDY

chemical use

MG: Upgrade to caustic (sodium hydroxide) recovery plant at Koroit

Murray Goulburn Co-operative Co. Ltd (MG) upgraded its caustic recovery plant at Koroit to increase the amount of caustic suitable for use. The upgrade reduced chemical costs while also lowering salt loadings in the wastewater used to irrigate MG's nearby farm.

The site routinely uses caustic and acid to clean all internal equipment and satisfy food safety and quality control requirements. While a caustic recovery and reuse system was in place, its capacity to recover caustic was limited.

The project team used site measurements to determine how much used caustic was going to drain and the quantity that improved cleaning systems could theoretically recover. They employed contract agronomists to quantify the soil health benefits that the reduction in salt loadings would have during farm irrigation.

Pilot trials predicted that installation of a nano-filtration (NF) membrane plant would provide 95% recovery rates of caustic and at a purity level well above the quality standard for reuse.

Projected financial savings were $350,000 per annum in unused fresh caustic, combined with reduced neutralising acid for final discharge.

In 2010/11, the Board approved funding for the installation of a fully-automated NF plant with a 100 kL storage tank for dirty caustic. The eight-month project also increased supply/recovery lines and valves around the site.

The upgrade was expected to provide additional efficiency savings as a result of reduced cleaning times on some equipment.

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The raw data used in this report was provided by participating companies in good faith; none of this data was independently assured or audited and no warranty is given for its accuracy or subsequent use.

The 2010/11 Environmental Sustainability Report was published in 2013.

Reducing Environmental Impact

The dairy industry strives to improve efficiencies and embrace innovation to reduce our environmental impact. The industry is investing in ways to reduce energy use; improve nutrient, land and water management; adapt to climate variability; enhance biodiversity; increase resilience; and reduce waste.