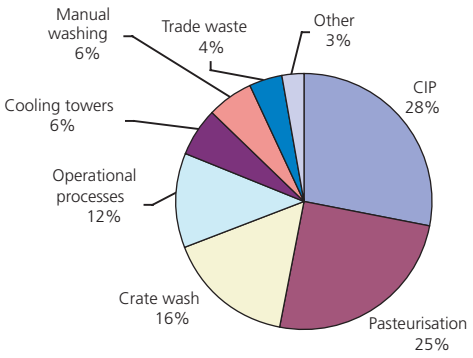
Eco-efficiency for Australian dairy processors

Fact sheet 1: Water management

Water use

Dairy factories use large quantities of water, and produce substantial volumes of relatively moderate strength liquid wastes. Water is used in processing and cleaning, for the operation of utilities such as cooling water and steam production, and for ancillary activities. The diagram below breaks down the water use of a market milk processor.



Many dairy processors track the overall consumption of water by monitoring the ratio of water to raw milk intake. In Europe, water consumption has been reported as ranging from 0.2 to 11 L/L milk, with effluent volumes per raw milk intake in the same range.[1] Ratios for Australian processors producing any combination of white milk, cheese, powders or yoghurts range from 0.07 L/L milk to 2.90 L/L milk, with the average being around 1.5 L/L milk.

TABLE 1: Water to milk ratios

Product	Min.	Max.	Average
White and flavoured only	1.05	2.21	1.44
Cheese and whey products	0.64	2.90	1.64
Powdered products	0.07	2.70	1.52

The true cost of water

The components that make up the total true cost of water for dairy processors are:

- Purchase price
- Treatment of incoming water
- Heating or cooling costs
- Treatment of wastewater
- Disposal of wastewater
- Pumping costs
- Maintenance costs (e.g. pumps and corrosion of pipework)
- Capital depreciation costs.

TABLE 2: Example of the true cost of ambient and hot water ($/kL)

Purchase	$0.54
Wastewater treatment[a]	$0.75
Wastewater pumping	$0.05
Wastewater discharge (volume charge)	$1.09
TRUE COST OF AMBIENT WATER	$2.43
Heating to 80°C[b]	$2.80
TRUE COST OF HOT WATER	$5.23

[a] Based on assumption of treatment costs for an anaerobic digester
[b] Cost for heating to 80°C using steam produced by a gas boiler

Water balance and flow measurement

Flow meters on high water using equipment, incoming water inlets and wastewater discharge outlets will allow regular recording and monitoring of water use.

Flow measurements can be used to develop a water balance for the factory, which will show where water is being used and how much. An up-to-date water balance is essential if water is to be managed effectively.

Every drop counts – Improved water management

Dairy Farmers at Lidcombe joined the Sydney Water 'Every Drop Counts' water-minimisation business partnership. The company installed 27 water meters across the site and worked on developing an accurate understanding of the water flow to each area. A water assessment identified savings that could be made by preventing cooling tower overflow; recirculating homogeniser water, crate wash water and DAF water; reducing water for cleaning; repairing leaks; and reviewing truck washing practices. The assessment identified total potential savings in water costs of $300 000/yr, at an initial cost of $150 000, and ongoing costs of $26 000/yr.

1 G Daufin et al. 'Recent and emerging applications of membrane processes in the food and dairy industry'. *Trans IChemE*, vol. 79(C2), 2001, pp. 89–102.

Eco-efficiency opportunities to reduce the demand for water

There are numerous opportunities to reduce water use:

- Optimise rate of water flow on equipment such as pump seals, sprays or homogeniser cooling water.
- Design and select equipment to minimise cleaning.
- Use dry cleaning techniques before wet cleaning.
- Optimise product changeovers to reduce cleaning.
- Report and repair leaks promptly.
- Optimise Clean-in Place systems by fine-tuning wash cycle times.
- Optimise crate washer operation by recirculating rinse water.
- Use trigger-operated controls on hoses.
- Optimise operation and maintenance of boilers and cooling towers.
- Recirculate equipment sealing water.
- Install water-efficient products in amenities.
- Consider collection and use of stormwater.

Reducing flow rates to homogeniser

Dairy Farmers in Mount Gambier reduced water costs by $10 800/yr by reducing the flow of cooling water to the homogeniser to the optimum rate. The cost was $250 for the installation of a flow regulation valve.

Fine-tuning of CIP systems

National Foods in Penrith, as part of a regular audit of CIP systems, reviewed the flush time of their pasteuriser. They were able to reduce the flush time by 12 min/day, which resulted in water savings of 15 ML/yr.

A hose left unattended for a total of one hour a day can lose $1000–$2000 every year.

Water reuse and installation of water-saving devices

Parmalat in Nambour used to send its pasteurised cleaning water to wastewater. Storage tanks and pipework have now been installed to allow the water to be reused for washing empty milk crates. In addition, water-saving devices have been attached to hoses used for cleaning. This has saved the company 1 kL of water per shift or 260 kL/yr.

Redesign of crate wash system

National Foods in Penrith redesigned its crate washer to allow the recirculation of water. The improvement saved 60 kL/day of water and $105 000/yr in water supply and discharge costs. The cost of implementation was $50 000.

Recirculation of vacuum pump sealing water

Murray Goulburn in Leitchville installed a water recirculation system on their vacuum pump. The water is cooled by an air-cooled radiator. The project was very successful, saving $27 000 on maintenance costs and 1.1 million L/yr of water that had previously been sent to drain. The cost of implementation was $15 000, which included a pump, balance tank, pipework and fan.

Overflow of water on cooling tower

Murray Goulburn in Leongatha conducted a water audit. It identified that one of the cooling towers was intermittently overflowing. The leak was measured at 120 L/min, which equated to around 57 000 L/day, assuming the leak occurred 30% of the time.

Take supply water meter readings during non-production hours to highlight any unusual water consumption or leaking pipes.

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For further information see the *Eco-efficiency for the Dairy Processing Industry Manual*, August 2004 or contact the UNEP Working Group for Cleaner Production: phone 07 3365 1432, email p.prasad@uq.edu.au
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