Final Report

AUSTRALIAN MEAT PROCESSOR CORPORATION

Econoliser

The Econoliser – Industry Trial and techno-economic tool

Project Code
2024-1002

Prepared by
Andreas Kiermeier
John Sumner
Jessica Jolley

Date Submitted
06/09/2024

Published by
AMPC

Date Published
06/09/2024

Contents

Executive Summary

The Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption (AS4696) specifies that facilities for cleaning and sanitizing implements be provided with an adequate supply of hot potable water at no less than 82°C or that implements receive an equivalent method of sanitizing. For the sanitizing of knives, this requirement is commonly achieved by meat processing establishments providing continuous flow knife sterilisers with at least 82°C water, where operators either dip their knife momentarily or place one knife in the steriliser while using a second knife on the carcase. However, due to their design, sterilisers overflow at a rate of 3-7 L/min and some are used infrequently, e.g. at the carton meat assessment table in the boning room. For this reason, AMPC and the Australian meat industry have been interested in alternatives with a smaller water footprint.

One such alternative, which has been used in European abattoirs for several years is the two-knife Econoliser (Airtech Distribution Ltd, Belfast, UK), which uses a high-pressure spray of only 140 mL of water greater than 82°C to sanitize the knife blade. The Econoliser units include a heating element which heats water of any temperature rapidly to the required >82°C. Given the potential water savings and associated energy and emissions savings, AMPC was interested in trialling the two-knife Econoliser units to determine whether they would achieve an equivalent microbiological outcome to the continuous flow sterilisers under Australian conditions.

In particular, the objectives of this project were to:

1. Validate the microbiological performance of the electric Econoliser in two beef and one sheep establishment.
2. Establish comparative water/power usage from sterilisers and Econolisers in both processes.
3. Establish emission intensities from sterilisers and Econolisers for both processes.
4. Develop an adoption guidance tool.
5. Department of Agriculture, Fisheries and Forestry (DAFF) national approval of the two-knife Econoliser.

The validation of the microbiological performance of the electric two-knife Econoliser, connected to the hot-water supply, was undertaken at two stations each at two beef and one sheep establishment. The stations on the processing chain consisted of the flanking stand and the boning room MHA stand at Plant A (Beef), the first leg and bunging at Plant B (Beef), and the Y-cut and the retain rail at Plant C (Sheep). At each station, knives were swabbed after having been inserted into the steriliser (n=25) or the Econoliser (n=25) and the Aerobic Plate Count (APC) and *E. coli* detection and count on the cleaned knife blade were determined on a per cm^2 basis. The Econoliser resulted in an equivalent microbiological outcome to the continuous flow steriliser provided the supplied water pressure was at least 35 PSI, as required by the manufacturer. Further in-plant trials at Plant B also indicated that warm water (approx. 40°C) needed to be supplied to the Econoliser to ensure adequate heating at the plant's chain speed. This will be an important consideration for most Australian plants, and especially those processing smallstock, due to the much higher chain speed compared with many European abattoirs.

To facilitate adoption of this technology, an Excel-based Adoption Guidance Tool was developed. The tool requires a series of inputs from the user, related to the number of sterilisers, water flow, operating hours, water and energy costs, etc. to calculate the comparative annual water consumption and cost, energy consumption and cost to heat water, and associated CO_2-equivalent emissions between traditional sterilisers and the Econoliser. This tool was subsequently used to evaluate several adoption scenarios, including: cold versus hot water supply to the Econoliser; small versus large number of animals processed; and replacing a single low-use steriliser with an Econoliser. Plants wishing to adopt the Econoliser are encouraged to use the tool to evaluate the potential cost savings that are achievable, given their unique inputs.

The findings from this work were disseminated via a webinar, an AMPC news article, and will be presented at the 2024 Mintrac MIQA Conference.

By the conclusion of this project, one of the trial plants had obtained approval from DAFF to use the two-knife Econoliser throughout the plant. In addition, a protocol for the successful adoption of the two-knife Econoliser and the daily monitoring requirements were documented to facilitate other plants adopting the Econoliser without having to undertake further microbiological testing, provided they meet the necessary requirements. In the case where plants need to adjust the operating parameters, a protocol has been developed to guide them in how to conduct the necessary validation work. These protocols have been accepted by the DAFF with the view of including the two-knife Econoliser on the department’s Approved Equipment list.

1.0 Introduction

Since the 1960s, there have been regulatory requirements in many countries for the use of hot water no cooler than 82°C for disinfection of knives and other implements used during slaughter and dressing operations. The premise for the requirement was that unless knives and other implements are disinfected by immersion into 82°C water, they may become a source of microbiological (cross-)contamination. Failure to maintain continuous flow knife sterilisers, or hereafter simply referred to as “sterilisers”, at 82°C can lead to suspension of slaughter and dressing.

The Australian Standard 4696 (Anonymous, 2007) specifies that facilities for cleaning and sanitizing implements be provided with an adequate supply of hot potable water at no less than 82°C or receive an equivalent method of sanitizing.

In 2003, MLA commissioned Food Science Australia to investigate firstly, whether there was any scientific basis for 82°C and secondly, whether alternative cleaning procedures were possible. After an exhaustive literature review and discussions with colleagues in USA, it was determined that the requirement was a simple conversion of 180°F, for which there was no scientific evidence. The researchers also demonstrated that temperatures cooler than 82°C could be used provided knives were immersed for longer than the momentary dip used with 82°C (Midgley and Eustace, 2003).

A significant amount of research and development over the next years (Eustace *et al.*, 2007; Goulter, Dykes and Small, 2008; Horchner, 2007) resulted in the acceptance by Meat Standards Committee in June 2007, that all jurisdictions would approve future proposals for the use of an alternative procedure for knife cleaning and sanitizing on the following basis:

- Verification of the use of the model by meat processing establishments to demonstrate equivalence, and
- Approval of an arrangement that demonstrates the capacity of the meat processing facility to operate in accordance with the proposal submitted to the controlling authority, and
- Subject to importing country requirements.

In 2019, an alternative knife cleaning and sanitizing procedure was evaluated on a beef slaughter chain at a Victorian abattoir. A comparison was made of contamination levels on knives after they had been cleansed by rinsing and dipping in 82°C water with those on knives cleaned by rinsing and placing in an Econoliser Twin Knife Steriliser (using 82°C water without electrical booster). From this trial, it was concluded that the Econoliser unit with 4-second and 6-second spray duration could decontaminate the knife at legging and bunging that is at least equivalent to the standard method used in Australian abattoirs. However, adoption did not proceed due to the difficulty in aligning HACCP methodology and economic claims made by the previous Australian distributor.

Since 2019, the Econoliser unit has been further developed to include an electric thermostat booster enabling greater range of input water temperature (0 to 90°C), and the non-electric units used in 2019 are no longer being distributed. In addition, the current Econoliser twin knife model uses only two spray nozzles for a knife of standard length used in slaughter and dressing, though a four-spray nozzle version is available for long butchering knives. The aim of this project was to trial these aspects with the required level of design stringency to raise confidence in its use for both beef and sheep slaughter chains. In addition, there was a desire to develop a tool that could help establishments quantify potential water, energy and carbon emission savings that could be realised with partial or full adoption of Econoliser units in an abattoir.

2.0 Project Objectives

The objectives of this project were to:

1. Validate the microbiological performance of the electric Econoliser in two beef and one sheep establishment.
2. Establish comparative water/power usage from sterilisers and Econolisers in both processes.
3. Establish emission intensities from sterilisers and Econolisers for both processes.
4. Develop an adoption guidance tool.
5. Department of Agriculture, Fisheries and Forestry (DAFF) national approval of the two-knife Econoliser.

3.0 Methodology

3.1 Participating Establishments

Based on discussion with the AMPC Project Manager, establishments were selected based on their interest in participating in the trial and their willingness and ability to install two Econoliser units within the timeframe required for the trial. Two establishments – Plant A (Beef) and Plant C (Sheep) – had already purchased Econoliser units and Plant B (Beef) was included as they had participated in the previous trial in 2019. These three establishments allowed trialling the Econoliser units on beef and sheep lines.

3.2 Econoliser Units

The Econoliser units used for this trial were those units available from Airtech Distribution Ltd, Belfast, UK at the end of 2023. In particular, the units were twin knife steriliser units with a built-in water heater and, because of this, the incoming water temperature can be between 0 and 92°C (depending on chain speed). Images of the units are shown in Figure 1. The main requirement for these units to work effectively is that water must be supplied at a pressure of at least 35 PSI; the manufacturer provided all three establishments with a pressure manifold, which can easily be swapped with the standard spray manifold, to help them ensure that pressure requirements were met.

a) b) c)

Figure 1: Econoliser unit used for the trial - a) full size including mounting column, b) overhead display and control box, c) knife cassette.

3.3 Sample Collection

Sample collection was undertaken on the following days:

- Plant A: 12 February 2024
- Plant B: 13 February 2024
- Plant C: 14 & 15 February 2024

At each plant, samples were collected at two sampling times, morning and afternoon, to include lot variability into the results. For logistical reasons, at Plant C the afternoon samples were collected on 14 February and the morning samples were collected the following day. At each sampling occasion, 12 or 13 samples were collected from each of the Econoliser and steriliser units, totalling n=25 samples for each.

Samples were collected in the following way. The knife was removed by the handle from the Econoliser or steriliser unit. Using a sterile glove, a sponge was removed from the sample bag and folded over the blunt spine of the knife blade. The sponge was then moved from the hilt to the tip of the blade while applying pressure (see Figure 2). The swab was then returned to the sample bag which was sealed.

Figure 2: Sample collection of knife blade swabs.

To estimate their area, knife blades were placed onto 5 mm graph paper and their outline traced.

3.4 Microbiological Testing

Sterile sponges (Whirl-Pak Speci-Sponge) were resuscitated with 25 mL of chilled Butterfield's solution, the knife blade was sponged as described above.

Sponged samples were maintained under refrigeration until laboratory testing, no more than 2 h after swabbing. Bacteria were removed from the sponge by "squishing" sponges by hand massage in the sample bags for 30 s and, from the moisture expressed, preparing serial dilutions in 0.1% buffered peptone water blanks (9 mL) using 1 mL aliquots. Aliquots (1 mL) from each dilution were spread on Aerobic Plate Count (APC) Petrifilm (3M, USA) and *E. coli* Petrifilm (3M, USA) and incubated at 32°C for 24-48 h. Colonies were identified and counted as per the manufacturer's instructions and expressed as colony forming units/cm^2 of knife blade.

3.5 Data Analysis

All microbiological concentrations were log_{10} transformed and data analyses were undertaken in the open-source statistical software R, version 4.3.2 (R Core Team, 2023).

The difference between the steriliser and Econoliser was analysed separately for each station in each plant.

Differences in detection proportions (for APC and *E. coli*) were assessed separately at each station using a two-sample test for equality of proportions.

Differences in the mean log_{10} APC concentration were analysed using a censored regression approach which assumes that non-detects did contain APC but that these were not detected on the Petrifilm due to their low number (Lorimer and Kiermeier, 2007).

3.6 Adoption guidance tool

A spreadsheet-based tool was developed in Microsoft Excel and revised throughout the project based in response to information obtained. The tool requires several inputs including the number of sterilisers installed in the plant and calculates water and energy consumption and CO_2 emissions for the current situation (all sterilisers) and assuming that all sterilisers are replaced with Econoliser units. The tool can therefore be used to evaluate different scenarios, including:

1) Replacing all sterilisers with Econolisers
2) Replacing a subset of sterilisers with Econolisers
3) Replacing a single steriliser – either low or high usage such as in the boning room or on the slaughter floor respectively – with an Econoliser
4) Using different incoming water temperature to the Econoliser.

It should be noted that the tool does not provide information on payback periods or other economic aspects, though these can readily be calculated using the tool's outputs.

Inputs into the tool include:

- Plant Location (state of Australia), which affects CO_2 emission calculations
- Number of slaughter floor (SF) steriliser units

- Number of boning room (BR; and other) steriliser units
- Average flow rate (Sterilisers only)
- Water use per cycle (Econoliser) – a default value of 0.14 L is used. This is a conservative amount based on information provided by Airtech Distribution Ltd. about the spray nozzle specification of 15 mL/s, i.e. two nozzles spraying for 4.5 seconds (factory default) amounts to 0.135 L per cycle.
- Average daily operating duration (i.e. duration for which flow of sterilisers is turned on)
- Average daily kill (SF) – assumes that the Econoliser is used once per carcase; this can be increased if some operations use the steriliser / Econoliser multiple time per carcase
- Average daily number of times knives are sterilised per unit (in BR & other); times per unit: In the boning room, it is common to not sterilise knives after every carcase, only when an abscess or lymph node is cut, for example. In other locations, knives may be sterilised very infrequently, e.g. only if they are dropped. Across all other non-slaughter floor units, how often would the steriliser be used daily, on average? It may only be 1, 5, or 10% of the total number of carcases processed per day.
- Number of operating days per year
- Water cost – assumes total cost of purchase and disposal per kL and that the two water amounts are the same
- Electricity cost
- Combustion source for water heating (used to look up the energy content)
- Cost to heat water (using plant's source above)
- Average incoming water temperature into plant – it is assumed that this temperature is used for the general plant heating as well as the input for the Econoliser; connecting the Econoliser to a warm or hot water line will reduce the benefit of the on-demand heating.
- Water temperature outgoing from heating source
- System efficiency (heat retention/loss) – this value relates to the total plant efficiency and includes losses associated with the boiler, heat exchanger, and pipes throughout the plant. Unless specific information has been collected by an establishment, a default value of 70% is used (steriliser calculations only).
- Water inlet temperature for Econoliser – this value should equal the plant incoming water temperature (default) but can be changed to any appropriate temperature depending on whether the Econoliser is plumbed into the warm (handwash) or hot (steriliser) supply.
- Water temperature (Econoliser) – the temperature that the Econoliser heats the water to (default is 94°C).

The tool then uses the inputs in combination with information listed in the “National Greenhouse and Energy Reporting (Measurement) Determination 2008” (Compilation No. 14, dated 1 July 2022) to calculate the following output – bold outputs are main outputs for the project while those in normal font are intermediary outputs that may be relevant for the user.

- Daily water usage
- **Annual water usage**
- **Annual cost of water**

- Annual amount of energy needed to heat water, for sterilisers, Econoliser and combined (when warm or hot water is used for the Econoliser); in GJ and converted to kWh.
- **Annual energy cost to heat water**
- Amount of combustion source needed to heat water
- CO_2, CH_4, N_2O and Total Emissions Factor
- Emission Factor (based on location) for grid electricity (used for the Econoliser only)
- **Total emissions (Econoliser only)**
- **Total emissions** – combines traditional water heating and Econoliser results when the warm or hot water supply is used with the Econoliser.

A screenshot of the tool is shown in Figure 3.

To help obtain some of the inputs, especially in relation to the water usage of sterilisers, some participating establishments purchased portable flow meters. They subsequently undertook an audit of their sterilisers which was used as an input to the tool.

Inputs			Units
Plant Location		SA	
Number of SF units		50	units
Number of BR (and other) units		10	units
Average flow rate (Sterilisers only)		4	L/min
Water use per cycle (Econoliser)		0.14	L
Average daily operating duration		9	hours
Average daily kill (SF)		1000	animals
Average daily number of times knives are sterilised per unit (in BR & other)		10	times/unit
Number of operating days per year		250	days
Water cost		4.2	$/kL
Electricity cost		$0.16	$/kWh
Combustion source for water heating	25: Town gas		
Energy content factor of combustion source		0.0393	GJ/m3
Cost to heat water (using plant's source above)		$1.83	$/kWh
Average incoming water temperature into plant		15	deg C
Water temperature outgoing from heating source		94	deg C
System heat retention efficiency		70%	
Water inlet temperature for Econoliser		15	deg C
Water temperature (Econoliser)		94	deg C
Outputs			
	Steriliser	**Econoliser**	
Daily water usage	129.60	7.01	kL
Annual water usage	32,400.00	1,753.50	kL
Annual cost of water	**$136,080**	**$7,365**	**$**
Annual energy needed to heat water (Hot water)	15,321	0	GJ
Annual energy needed to heat water (Econliser)		580	GJ
Annual energy needed to heat water (Combined)	15,321	580	GJ
Annual energy needed to heat water (Hot water; unit change)	4,255,843	0	kWh
Annual energy needed to heat water (Econoliser; unit change)		161,454	kWh
Annual energy needed to heat water (Combined; unit change)	4,255,843	161,454	kWh
Annual energy cost to heat water	**7,796,964.0**	**25,832.7**	**$**
Amount of combustion source needed to heat water supply	389,848.2	0.0	kL or m3
CO2 emission factor	60.2		kg CO2-e/GJ
CH4 emission factor	0.04		kg CO2-e/GJ
N2O emission factor	0.03		kg CO2-e/GJ
Total emissions factor	60.27		kg CO2-e/GJ
Emission Factor (based on location) for grid electricity		0.25	kg CO2-e/kWh
Total emissions (Econoliser only)		**40.4**	**t CO2-e**
Total emissions	**923.4**	**40.4**	**t CO2-e**

Figure 3: Screenshot of the adoption guidance tool

3.7 Case Studies

Reports on the microbiological validation of the Econoliser were provided to each participating plant to allow them to apply for ongoing use of the Econoliser through an amendment to their Approved Arrangement with the Department of Agriculture, Fisheries and Forestry (DAFF).

In addition, case studies for water, energy and emissions were included in these reports for two of the three participating plants – these case studies were based on plants' specific interests for adoption of Econoliser. Plant B declined to provide water and energy related cost data, citing commercial in-confidence / competitive advantage as a justification. Consequently, this plant was provided with the adoption guidance tool and user guide to allow them to undertake their own assessment.

3.8 Industry Webinar

A one-hour webinar was held on 11 April 2024 (14:00 to 15:00 AEST) to disseminate the findings from the trial and demonstrate the use of the adoption guidance tool. Participants were invited by AMPC based on their previous interest in the Econoliser.

3.9 Scientific Manuscript

The original intent for this part of the project was to disseminate the findings from the Econoliser trial to enable industry adoption. After trying to find a suitable journal for publication, it became quickly apparent that the two main aspects of the work – the microbiological evaluation and water/energy/emissions savings – would unlikely be suitable to be published together in a single journal and on their own, would not provide enough scientific novelty for publication. Accordingly, it was decided in collaboration with AMPC that publicising the findings within the Australian meat industry would be of greater benefit. Subsequently, an article was drafted for publication via AMPC monthly updates.

3.10 DAFF national approval of the two-knife Econoliser

The project team worked with DAFF and a trial plant sponsor on gaining national approval for the twin-knife Econoliser and relevant operating parameters that need to be met for successful operation.

4.0 Results

4.1 Installation and use of Econoliser Units

Plant A: The units were installed at the flanking stand (hide clearing cuts) and at entry to the boning room at the lower (forequarter) MHA stand. The units were plumbed into the steriliser line (>82°C) and the pressure achieved was 24 PSI. Both units used the standard spray time of 4.5 seconds as set by the factory. The line speed was 92 animals per hour (1.5 animals per minute).

At the flanking stand, the operator alternated between a standard knife and an airknife which was not evaluated in the trial, and rinsed the hands, knife and airknife between different cuts. The knife was swabbed while the operator was using the airknife.

At the MHA stand, the operator used a single knife for removing MHA defects, which was inserted into the steriliser or Econoliser between carcases.

Plant B: The units were installed at the first leg (hide clearing cuts) and at the bunging stand. The units were plumbed into the steriliser line (>82°C) and the pressure achieved was 35 to 40 PSI. Both units used the standard spray time of 4.5 seconds as set by the factory. The line speed was approximately 1 animal per 30 seconds (2 animals per minute).

At the first leg, the operator alternated between two knives for different cuts on each carcase. The operator rinsed hands and knife after each cut before inserting the knife into the steriliser/Econoliser. One knife was swabbed while the operator was using the other.

At the bunging stand, the operator cut around the anus before inserting the knife into the steriliser/Econoliser (without prior rinsing) and inverting a plastic bag over the bung, securing it with a rubber band before pushing it into the cavity.

Plant C: The units were installed at the first leg (Y-cut) and at the retain rail and plumbed into the steriliser (>82°C) water mains. The water pressure achieved was 35 to 40 PSI.

Due to the line speed of 9.2 animals per minute, the Y-cut is performed by two operators on alternating carcases – only one of these was part of the trial. Due to the fast line speed, the water spray time was reduced to 3 seconds at the Y-cut. In addition, the Y-cut operator was instructed to rinse the knife under hand wash water prior to inserting it into the Econoliser to wash off loose wool from the knife to prevent clogging of the unit. This was not done for the steriliser which effectively removed the wool from the knife during insertion, though the steriliser frequently became blocked with wool.

At the retain rail, the spray remained at the standard 4.5 seconds. The operator used a single knife to make multiple cuts on a single carcase and rinsed knife and hands before inserting the knife into the steriliser/Econoliser.

4.2 Microbiological Results

A summary of the trial results is shown in Table 1, from which it can be seen that overall, the continuous flow steriliser and Econoliser performed similarly in relation to APC and *E. coli*. It must be noted that a difference of less than 0.5 $\log_{10}$ cfu/cm^2 is not considered practically important from a microbiological perspective and hence the steriliser and Econoliser – as used in this trial – can generally be considered equivalent.

The result of the analysis for each plant and station are as follows:

- Plant A:
  - Flanking stand: No significant difference in APC detections (P-value = 0.70), and no significant difference in APC concentrations (P-value = 0.35).
  - Boning room MHA stand: Significant difference in APC detections (P-value = 0.02) with more detections obtained from knives inserted into the Econoliser. Also, significant difference in APC concentrations (P-value = 0.006) was obtained, with the Econoliser resulting in an estimated 0.6 $\log_{10}$ cfu/cm^2 higher APC concentration compared with the steriliser. It must be noted that at this plant, the minimum water pressure requirement was not met.
- Plant B:
  - First leg: No significant difference in APC detections (P-value = 0.56), and no significant difference in APC concentrations (P-value = 0.68).
  - Bunging: No significant difference between APC detections (P-value = 0.54), and no significant difference in APC concentrations (P-value = 0.21).

- Plant C:
  - Y-cut: No significant difference in APC detections (P-value = 1) but very significant difference in APC concentrations (P-value < 0.001). In this location, the Econoliser resulted in an estimated 0.73 $\log_{10}$ cfu/cm^2 lower APC concentration compared with the steriliser. It must be noted that at this station, the knife was rinsed in the handwash basin prior to inserting into the Econoliser but not the steriliser. The difference in *E. coli* detection was not statistically significant (P-value = 0.11).
  - Retain rail: Significant difference in APC detections (P-value = 0.003) with fewer detections obtained from knives inserted into the Econoliser. Also, very significant difference in APC concentrations (P-value = 0.001) was obtained, with the Econoliser resulting in an estimated 0.6 $\log_{10}$ cfu/cm^2 lower APC concentration compared with the steriliser. The difference in *E. coli* detection was not statistically significant (P-value = 0.11).

Table 1: Summary of trial results by plant; APC are reported on a cfu/cm^2 basis.

Plant	Station	Equipment	n	% APC detected	Mean $\log_{10}$ APC*	Mean APC**	% *E. coli* detected
A	Flanking	Steriliser	25	80	0.32	2.1	0
		Econoliser	25	88	0.16	1.5	0
	BR Pre-trim	Steriliser	25	56	-0.16	0.69	0
		Econoliser	21***	90.5	0.45	2.81	0
B	First leg	Steriliser	25	68	-0.48	0.33	0
		Econoliser	25	56	-0.56	0.28	0
	Bunging	Steriliser	25	76	-0.06	0.87	0
		Econoliser	25	64	-0.40	0.40	0
C	Y-cut	Steriliser	25	100	1.30	19.9	4
		Econoliser	25	100	0.57	3.8	0
	Retain	Steriliser	25	100	0.47	2.9	0
		Econoliser	25	64	-0.11	0.7	4

* Estimated from the model, taking non-detects into account.
** Geometric mean, on the arithmetic scale, obtained by exponentiating the estimated “Mean $\log_{10}$ APC”.
*** Four samples were excluded due to technical problems during sample collection.

4.3 Observations

The following observations were made throughout the trial:

- Bunging and the boning room MHA stand were locations where knives were subjected to fat contamination and small pieces sometimes remained on the knife blade after removal from both the steriliser and

Econoliser. It should be noted that the water pressure at the boning room MHA stand was less than the required 35 PSI, which will have contributed to the lack of fat removal.

- The Y-cut operator was instructed to rinse the knife prior to using the Econoliser as clumps of wool always adhered to the knife blade at this station. This took extra time and it may be difficult for the operator to rinse at times were a second Y-cut operator not available. To compensate for the extra time required for rinsing, the Econoliser spray time was reduced to 3 seconds, without any negative effect on the microbiological results.
- A lamp showing when the spray is in operation would be a useful addition to allow operators to “see” when the Econoliser is spraying or not, e.g. if it has not been activated. Such an addition would be particularly useful at points such as the retain rail or in the boning room, i.e. where the normal slaughter line speed is not observed. In addition, this will assist supervisors monitor operators’ knife sterilising. The manufacturer has indicated that such an inclusion is planned as part of the next iteration of Econoliser units.
- All plants participating in the trial had connected the Econoliser to the hot water (>82°C) supply line. This was mainly done for pressure reasons. Depending on a plant’s specific situation, this will affect the outputs from the adoption guidance tool (see also “Cold water versus hot water supplied to the Econoliser”).

4.4 Water, energy and emissions

In Table 2 are listed the inputs for a representative beef abattoir to illustrate the use of the tool and demonstrate the types of water, energy and emissions savings that are possible. It should be noted that abattoirs interested in the Econoliser should use the tool with their specific inputs to get a better understanding of the potential benefits.

Table 2: Inputs to adoption guidance tool for a representative abattoir located in Victoria.

Input	Example
1. Plant location	VIC
2. Number of SF units	50
3. Number of BR (and other) units	10
4. Average flow rate (Sterilisers only; L/min)	4
5. Water use per cycle (Econoliser; L/cycle)	0.14
6. Average daily operating duration (h)	9
7. Average daily kill (SF)	500
8. Average daily number of times knives are sterilised per unit (in BR & other)	10
9. Number of operating days per year	250
10. Water cost ($/kL)	3.75
11. Electricity cost ($/kWh)	0.16

Input	Example
12. Combustion source for water heating	17: Natural gas distributed in a pipeline
13. Cost to heat water (using plant's source; $/kWh)	0.20
14. Average incoming water temperature into plant (°C)	15
15. Water temperature outgoing from heating source (°C)	95
16. System efficiency (heat retention/loss; %)	70
17. Water inlet temperature for Econoliser (°C)	15
18. Water temperature (Econoliser) (°C)	94

In Table 3 is summarised the output from the adoption guidance tool for the inputs listed in Table 2, comparing the steriliser and Econoliser. Note that these outputs assume 100% adoption of the Econoliser, i.e. replacement of all continuous flow knife sterilisers with Econolisers. From these results, it can be seen that full adoption of the Econoliser can result in substantial reductions of water use and cost, energy use and costs and total emissions.

Table 3: Outputs from the adoption guidance tool, using the inputs from Table 2.

Outputs	Steriliser	Econoliser
Daily water usage (kL)	129.60	3.51
Annual water usage (kL)	32,400	879
Annual cost of water ($)	121,500	3,294
Annual energy needed to heat water (GJ)*	15,515	291
Annual energy cost to heat water ($)*	861,943	12,960
Total emissions (t CO_2-equivalent)*	799.5	68.9

* The output is for the steriliser versus the Econoliser only as the Econoliser is supplied with cold water in this scenario.

As noted above, different adoption scenarios can be evaluated using the adoption guidance tool. In the following sections, several scenarios are evaluated by changing one or more of the inputs in Table 2 while keeping the remaining unchanged.

4.4.1 Cold water versus hot water supplied to the Econoliser

All three trial plants utilised the hot water as the supply for the Econoliser. This was done as the hot water supply was considered to be able to achieve the required pressure at the Econoliser by the plant engineer. This water has to be heated using the traditional fuel source and transported to the Econoliser, thus losing temperature, and potentially missing out on the on-demand heating benefit of the Econoliser. However, cold water will take longer to be heated by the Econoliser and may thus only be useful for slow moving chains; the manufacturer indicated that most plants use warm hand-wash water. This scenario was evaluated by changing the incoming water temperature (Input 17; Table 2) for the Econoliser from 15°C to 82°C. While there is no change to the water consumption and cost, the energy and emission outputs are affected as follows.

- The annual energy needed to heat water increases from 291 GJ to 396 GJ and is comprised of 352 GJ to heat the water using the abattoir's fuel source and 44 GJ for the Econoliser to heat the water from 82°C to 94°C.
- The annual energy cost to heat water increases from $12,960 to $21,572.
- The total emissions decreased from 68.9 t CO_2-eq to 28.8 t CO_2-eq, of which 10.6 t CO_2-eq were associated with the Econoliser only.

It must be noted that these results are plant location and heating source/cost specific. For example, the same plant in South Australia would have a much smaller total emission of 20.3 t CO_2-eq under the cold-water scenario, and this would increase to 21.3 t CO_2-eq under the hot water scenario. Similarly, one of the trial abattoirs had access to a fuel source that is cheaper than grid electricity and hence their energy costs would increase using the Econoliser.

Of note, Plant B undertook additional trials using different input water temperatures to evaluate the Econoliser's ability to heat the water. During these trials, it was observed that it took longer for the Econoliser to reach operating temperature (>90°C) in time for the next activation (at a speed of 2 animals per minute), when the inlet water temperature was less than approximately 15°C. Discussions with Airtech Distribution Ltd confirmed this, leading to the conclusion that cold water may only be suitable for very slow moving chains, while warm, hand-wash water (approximately 40°C) would be suitable for most Australian processors.

Clearly, the benefits must be assessed on an abattoir specific basis.

4.4.2 Small versus large number of animals processed

Small stock abattoirs process many more animals than large stock and as a result, use each steriliser more often (assuming knives are sterilised between carcases). Leaving all other inputs as per Table 2, the effect of changing the Average daily kill (Input 7; Table 2) from 500 to 5,000 and the average daily number of knife dips per boning room (and other) steriliser from 10 to 100 (Input 8; Table 2) was evaluated. The results are summarised in Table 4. Since sterilisers operate on a constant flow rate (assumed to be) independent of slaughter volume, the results for the steriliser are unchanged. In contrast, given the 10-fold increase in slaughter (and boning) volume, the various outputs also increase 10-fold for the Econoliser.

Table 4: Outputs from the adoption guidance tool, using the inputs from Table 2, with an average daily kill of 5,000 animals.

Outputs	Steriliser	Econoliser
Daily water usage (kL)	129.60	35.14
Annual water usage (kL)	32,400	8,785
Annual cost of water ($)	121,500	$32,944
Annual energy needed to heat water (GJ)	15,515	2,908
Annual energy cost to heat water ($)	861,943	129,277
Total emissions (t CO_2-equivalent)	799.5	686.8

4.4.3 Low frequency use steriliser

One attraction of the Econoliser is its low water usage which seems particularly suited to situations where a knife is sterilised infrequently. An example of such an operation is the Carton Meat Assessment station in the boning room where the knife usually only requires sterilising after a defect has been removed, which usually happens infrequently, e.g. 10 times per day. To evaluate this scenario, the number of slaughter floor units is set to zero (Input 2; Table 2) and the number of boning room and other units is set to 1 (Input 3; Table 2), with all other inputs as specified in Table 2. The results for this single steriliser replacement are shown in Table 5.

Table 5: Outputs from the adoption guidance tool, using the inputs from Table 2, for only a single boning room steriliser compared with the Econoliser.

Outputs	Steriliser	Econoliser
Daily water usage (kL)	2.16	0.00
Annual water usage (kL)	540.00	0.35
Annual cost of water ($)	2,025	1
Annual energy needed to heat water (GJ)	259	0.12
Annual energy cost to heat water ($)	14,366	41
Total emissions (t CO_2-equivalent)	13.3	0.2

4.5 Industry webinar

An industry webinar held on 11 April 2024 was attended by a total of 15 people, including the presenters, Robin Adair (Airtech Distribution Ltd) and Matt Deegan (AMPC). The webinar was recorded and has been made available on AMPC's YouTube channel at: https://www.youtube.com/watch?v=EIO-WqtJYU0.

As a result of the webinar, the project was varied to include Objective 5: DAFF national approval of the two-knife Econoliser to better faciliate adoption of the two-knife Econoliser by the Australian meat industry.

4.6 Scientific Manuscript

As noted in the Methodology, it was decided to publicise the work via an AMPC News article, which was published on 24 May 2024 at https://www.ampc.com.au/news-events/news/trial-confirms-savings-from-new-knife-sanitiser. The article text is also included in Appendix 2: AMPC News Article.

4.7 DAFF national approval of the two-knife Econoliser

To facilitate the national approval of the two-knife Econoliser, a protocol was developed for consideration by DAFF. The protocol is included in "Appendix 3: A protocol for verifying the installation and operation of Econoliser units in Australian abattoirs" and contains information on:

- Background for existing 82°C requirement,
- Trial information for the two-knife Econoliser including operating parameters established during trials,
- Guidelines for plants on how to verify equivalence when applying for variations to operating parameters, and

- A checklist for verifying that an Econoliser has been installed so that effective knife cleaning can occur, including regular monitoring of operating parameters.

The protocol was discussed on-site (Plant B) with DAFF staff, including Jason Ollington, on 3 July 2024 followed by demonstration of the two-knife Econoliser on the bunging stand. The outcome of this meeting was that DAFF would consider the protocol internally with a plan to publish the protocol on the DAFF website as part of the approved equipment list as a way of showing acceptance of the protocol.

5.0 Discussion

The two-knife Econoliser units have been adopted and distributed in Europe by Airtech Distribution Ltd, since their invention in 2012 in Northern Ireland. Despite this, only two citations could be found mentioning the term "Econoliser", neither of which related to the microbiological evaluation of the two-knife Econoliser's performance. Consequently, the aim of this project was to demonstrate the Econoliser equivalence with traditional continuous flow knife sterilisers under Australian conditions.

Based on the findings of the in-plant trials assessing the microbiological performance, it can be concluded that the two-knife Econoliser can produce an equivalent microbiological outcome to the steriliser, provided certain operating parameters are met. The first of these relates to the time available for the operator to perform the necessary cuts, rinse the knife, insert it into the Econoliser while a second knife is being sanitised. Using a factory setting of a 4.5 s spray cycle, it may be difficult for the operator to perform all tasks on a fast-moving line. For example, the sheep line in this trial (Plant C) ran at 9.2 head/minute, or 6.5 s per carcase, and this proved difficult for the operator. Faster moving sheep lines (e.g. 12 head/minute) are clearly going to be very challenging in this respect. However, even on a slower beef line, not all stations may be suitable. For example, Plant B ran at 2 head per minute, or 30 seconds per carcase. However, at the first leg, the operator made three separate hide-opening cuts, thus requiring the knife to be changed three times, and having approximately 10 s to wash hands and steel the knives. Even at this station, the default spray duration was too long to allow successful implementation.

The second aspect relates to the need to rinse the knife prior insertion into the Econoliser to remove hair/wool and physical detritus on the knife. While cleaning of equipment prior to sanitizing is a requirement in the EU as well as under the Australian Standard (AS 4696), this step is sometimes not performed on fast moving chains. As a result, the two-knife Econoliser may be more suitable for slower moving chains, hide-off areas, or in areas where knife sanitizing is done less frequently than on the slaughter floor, such as in the offal and boning rooms or the load-out areas.

A third aspect relates to the water pressure that is supplied to the Econoliser, which needs to be a minimum of 35 PSI. Commonly, plant engineers are concerned with the pressure at the hot water source (e.g. boilers) and during the trial, it was commonly stated that "We have plenty of pressure – 7 bar [101 PSI] at the pump". However, this mindset ignores the fact that pressure reduces with each steriliser and tap down the line, resulting in less than 35 PSI even well before the end of the ring main. Consequently, booster pumps were installed by two plants to achieve the necessary pressure, which led to a successful outcome. Such booster pumps are likely needed if a plant wishes to only convert a small number of infrequently used sterilisers to Econolisers, e.g. at the carton meat assessment table. However, broad-scale adoption on the slaughter floor can, according to Airtech Distribution Ltd, be done by converting sterilisers to Econolisers closest to the pump and working down the line. This is because each Econoliser bleeds off less pressure than a steriliser, thus allowing higher pressure to be maintained for longer.

While not directly evaluated in this project, the energy savings that are achievable depend on the incoming water temperature, which in turn needs to be considered in the context of the line speed. According to Airtech Distribution

Ltd and observed by one plant during further water temperature trials, more time is needed by the Econoliser to heat the water when colder water is used. Consequently, a fast slaughter line is unlikely to be able to utilise cold water as an input. It is recommended that plants wishing to adopt the Econoliser discuss their situation with the manufacturer prior to purchase and installation of the units.

With respect to water, energy and emissions, an Excel-based calculator tool was developed to allow interested plants to evaluate the potential benefits prior to adoption and several adoption scenarios were developed and quantified. From these, it can readily be seen that the smaller the number of activations/sanitizing events (i.e. number of animals) the greater the potential benefits in relation to water and energy savings. This is due to the small water footprint (140 mL per activation) of the Econoliser units and hence the Econoliser is very attractive for stations that require infrequent sanitizing, e.g. load-out or carton meat assessment. Furthermore, using cold water instead of warm or hot water improves the energy savings, though this needs to be balanced against the Econoliser's ability to heat the water in time for the next activation, as discussed above. However, at stations of infrequent use, this is unlikely to be a hurdle.

In addition to the benefits related to water, energy and emissions, the Econoliser also reduces the risk of hot water burns related to sterilisers. This Work Health and Safety benefit was highlighted by several of the participating plants though no specific details on number of injuries were provided.

The trial units used in this project (including various extras) cost approximately AU$7500 each (including shipping). Using the scenario of a single boning room steriliser replacement, the cost savings for water and energy combined, as based on the results in Table 5, are $16,348 (per year). This implies that the payback period for this scenario is 12 months × $7500 / $16348 = 5.5 months. However, it should be noted that these results are specific to each plant (based on water, fuel source and energy costs) and thus need to be evaluated on a plant-by-plant basis.

5.1 Adoption

As a result of this trial, Plant C has put forward an amendment to their Approved Arrangement to DAFF to continue using the two Econoliser units in the positions used in this trial.

In addition, DAFF have at the time of writing agreed to consider including Airtech Distribution Ltd and the two-knife Econoliser on their approved equipment, together with the protocol (Appendix 3).

6.0 Conclusions / Recommendations

In this project, the microbiological performance of the two-knife Econoliser was compared with traditional continuous-flow knife sterilisers at two stations at each of two beef establishments and one sheep establishment. The results indicate that the Econoliser can achieve an equivalent microbiological outcome, using the default operating parameters, provided that the supply water pressure is at least 35 PSI. While such a pressure is readily available at the beginning of the ring main, i.e. boiler and pump, the water pressure drops with each continuous flow steriliser on the line. Therefore, establishments wishing to install only one or a few Econolisers at various low-use locations, e.g. at carton meat assessment or load-out, may need to consider installing booster pumps to ensure the required pressure is achieved. In contrast, establishments wishing to fully adopt the Econoliser should start deployment closest to the main pump and work down the line as this will help maintain water pressure for longer.

The potential water, energy and emissions savings can be calculated by plant staff using the Excel-based Adoption Guidance Tool, which can be used to evaluate various scenarios. It is important that establishments use plant specific inputs as the costs of water purchase and discharge, cost and type of heating fuel source used, as well as location of the plant in Australia affect the outputs from the tool. In general, greater savings can be achieved when daily slaughter volume is lower and when colder water is used as the input. However, the incoming water temperature needs to be considered in relation to slaughter volume as fast smallstock chains are likely to overwhelm the Econoliser's ability to heat cold water in time; for these plants, warm hand wash water is generally adequate. These considerations will affect the payback period and long-term financial benefits of the Econoliser.

At the time of writing, the Department of Agriculture, Fisheries and Forestry are considering the trial findings and associated protocols for adoption without establishments having to undertake further microbiological testing. It is expected that the two-knife Econoliser will be listed as part of the department's Approved Equipment list in the near future. This will simplify the broader adoption of the Econoliser, though establishments may still require additional assistance related to (a) the completion of the Adoption Guidance Tool inputs, (b) evaluation of slaughter and dressing steps that may be suitable for adoption of the Econoliser, and (c) deployment of Econolisers.

7.0 Bibliography

Anonymous. 2007. *AS4696:2007—Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption*. AS. 3 (FRSC Technical Report). 150 Oxford Street (PO Box1139), Collingwood, VIC 3066, CSIRO Publishing.

Eustace, I., Midgley, J., Giarrusso, C., Laurent, C., I. & Sumner, J. 2007. An alternative process for cleaning knives and equipment used on meat slaughter floors. *International Journal of Food Microbiology*, 1(1): 23–27.

Goulter, R.M., Dykes, G.A. & Small, A. 2008. Decontamination of Knives Used in the Meat Industry: Effect of Different Water Temperature and Treatment Time Combinations on the Reduction of Bacterial Numbers on Knife Surfaces. *Journal of Food Protection*, 71(7): 1338–1342. https://doi.org/10.4315/0362-028X-71.7.1338

Horchner, P. 2007. *Technical support on the application of <82°C water for knife and equipment sterilisation*. PRMS.084(V1). North Sydney, Meat and Livestock Australia.

Lorimer, M.F. & Kiermeier, A. 2007. Analysing microbiological data: Tobit or not Tobit? *International Journal of Food Microbiology*, 116(3): 313–318.

Midgley, J. & Eustace, I. 2003. *Investigation of alternatives to 82°C water for knife and equipment sterilisation*. North Sydney, Meat and Livestock Australia.

R Core Team. 2023. *R: A Language and Environment for Statistical Computing*. Vienna, Austria, R Foundation for Statistical Computing. https://www.R-project.org/

8.0 Appendices

Appendix 1: Trial Data

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
12/02/2024	A	Flanking	Steriliser	1	1	41	31	0	2.11	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	2	41	5	0	11.58	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	3	41	42	0	3.16	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	4	41	9	0	1.84	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	5	41	20	0	6.84	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	6	41	5	0	4.47	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	7	41	13	0	1.32	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	8	41	6	0	2.11	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	9	41	3	0	12.63	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	10	41	12	0	2.63	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	11	41	0	0	1.84	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	12	41	0	0	3.42	0	<0.26
12/02/2024	A	Flanking	Steriliser	1	13	41	3	0	5.00	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	14	41	9	0	4.74	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	15	41	1	0	3.42	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	16	41	5	0	0.26	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	17	41	0	0	3.95	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	18	41	0	0	5.00	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	19	41	0	0	1.84	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	20	41	4	0	3.95	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	21	41	1	0	5.26	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	22	41	63	0	21.84	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	23	41	1	0	7.37	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	24	41	2	0	10.79	0	<0.26
12/02/2024	A	Flanking	Steriliser	2	25	41	1	0	2.63	0	<0.26

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
12/02/2024	A	Flanking	Econoliser	1	26	41	5	0	2.63	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	27	41	1	0	1.05	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	28	41	1	0	2.11	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	29	41	9	0	1.84	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	30	41	1	0	5.79	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	31	41	1	0	2.63	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	32	41	0	0	32.11	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	33	41	2	0	1.84	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	34	41	5	0	16.32	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	35	41	1	0	6.32	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	36	41	4	0	7.89	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	37	41	0	0	3.42	0	<0.26
12/02/2024	A	Flanking	Econoliser	1	38	41	1	0	13.95	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	39	41	3	0	1.05	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	40	41	7	0	2.37	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	41	41	1	0	1.32	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	42	41	8	0	12.63	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	43	41	3	0	0.53	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	44	41	1	0	0.26	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	45	41	25	0	<0.26	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	46	41	0	0	8.16	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	47	41	1	0	12.89	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	48	41	4	0	2.63	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	49	41	20	0	6.84	0	<0.26
12/02/2024	A	Flanking	Econoliser	2	50	41	17	0	0.53	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	51	41	1	0	1.05	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	52	41	1	0	<0.51	0	<0.51
12/02/2024	A	BR Pre-trim	Steriliser	1	53	41	2	0	<0.26	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	54	41	0	0	0.26	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	55	41	1	0	1.32	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	56	41	3	0	<0.26	0	<0.26

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
12/02/2024	A	BR Pre-trim	Steriliser	1	57	41	0	0	1.05	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	58	41	2	0	2.63	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	59	41	4	0	3.95	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	60	41	0	0	0.53	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	61	41	1	0	0.53	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	62	41	1	0	0.53	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	1	63	41	0	0	2.11	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	64	41	0	0	0.53	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	65	41	6	0	3.95	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	66	41	0	0	0.53	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	67	41	0	0	0.26	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	68	41	0	0	<0.26	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	69	41	0	0	<0.26	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	70	41	0	0	1.32	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	71	41	94	0	0.26	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	72	41	21	0	0.79	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	73	41	0	0	<0.26	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	74	41	1	0	<0.26	0	<0.26
12/02/2024	A	BR Pre-trim	Steriliser	2	75	41	44	0	0.53	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	76	41	6	0	0.53	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	77	41	1	0	18.95	1	0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	78	41	1	0	89.47	4	1.05
12/02/2024	A	BR Pre-trim	Econoliser	1	79	41	7	0	10.79	12	3.16
12/02/2024	A	BR Pre-trim	Econoliser	1	80	41	4	0	12.63	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	81	41	19	0	1.58	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	82	41	25	0	21.05	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	83	41	42	0	3.68	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	84	41	38	0	10.53	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	85	41	1	0	2.37	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	86	41	3	0	3.42	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	1	87	41	0	0	7.37	0	<0.26

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
12/02/2024	A	BR Pre-trim	Econoliser	1	88	41	7	0	0.79	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	89	41	200	1	1315.79	500	131.58
12/02/2024	A	BR Pre-trim	Econoliser	2	90	41	200	1	3.16	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	91	41	200	1	2.63	1	0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	92	41	200	1	1.58	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	93	41	6	0	13.95	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	94	41	1	0	6.84	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	95	41	51	0	17.89	1	0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	96	41	2	0	1.58	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	97	41	0	0	10.26	2	0.53
12/02/2024	A	BR Pre-trim	Econoliser	2	98	41	15	0	5.53	0	<0.26
12/02/2024	A	BR Pre-trim	Econoliser	2	99	41	5	0	84.21	17	4.47
12/02/2024	A	BR Pre-trim	Econoliser	2	100	41	4	0	1.84	0	<0.26
13/02/2024	B	First leg	Steriliser	1	1	91	2	0	18.90	0	<0.61
13/02/2024	B	First leg	Steriliser	1	2	91	0	0	3.05	0	<0.61
13/02/2024	B	First leg	Steriliser	1	3	91	5	0	25.61	0	<0.61
13/02/2024	B	First leg	Steriliser	1	4	91	5	0	5.49	0	<0.61
13/02/2024	B	First leg	Steriliser	1	5	91	1	0	12.20	0	<0.61
13/02/2024	B	First leg	Steriliser	1	6	91	6	0	3.05	0	<0.61
13/02/2024	B	First leg	Steriliser	1	7	91	0	0	7.93	0	<0.61
13/02/2024	B	First leg	Steriliser	1	8	91	0	0	3.66	0	<0.61
13/02/2024	B	First leg	Steriliser	1	9	91	0	0	1.83	0	<0.61
13/02/2024	B	First leg	Steriliser	1	10	91	1	0	7.32	0	<0.61
13/02/2024	B	First leg	Steriliser	1	11	91	0	0	<0.61	0	<0.61
13/02/2024	B	First leg	Steriliser	1	12	91	2	0	<0.61	0	<0.61
13/02/2024	B	First leg	Steriliser	1	13	91	0	0	1.83	0	<0.61
13/02/2024	B	First leg	Steriliser	2	14	91	0	0	5.49	0	<0.61
13/02/2024	B	First leg	Steriliser	2	15	91	7	0	0.61	0	<0.61
13/02/2024	B	First leg	Steriliser	2	16	91	1	0	3.05	0	<0.61
13/02/2024	B	First leg	Steriliser	2	17	91	2	0	<0.61	0	<0.61
13/02/2024	B	First leg	Steriliser	2	18	91	1	0	<0.61	0	<0.61

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
13/02/2024	B	First leg	Steriliser	2	19	91	3	0	<0.61	0	<0.61
13/02/2024	B	First leg	Steriliser	2	20	91	1	0	2.44	0	<0.61
13/02/2024	B	First leg	Steriliser	2	21	91	3	0	0.61	0	<0.61
13/02/2024	B	First leg	Steriliser	2	22	91	3	0	38.41	0	<0.61
13/02/2024	B	First leg	Steriliser	2	23	91	1	0	0.61	0	<0.61
13/02/2024	B	First leg	Steriliser	2	24	91	0	0	1.22	0	<0.61
13/02/2024	B	First leg	Steriliser	2	25	91	2	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	1	26	91	1	0	3.05	0	<0.61
13/02/2024	B	First leg	Econoliser	1	27	91	0	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	1	28	91	0	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	1	29	91	1	0	5.49	0	<0.61
13/02/2024	B	First leg	Econoliser	1	30	91	0	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	1	31	91	0	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	1	32	91	0	0	<0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	1	33	91	4	0	1.22	0	<0.61
13/02/2024	B	First leg	Econoliser	1	34	91	83	0	3.05	0	<0.61
13/02/2024	B	First leg	Econoliser	1	35	91	1	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	1	36	91	1	0	2.44	0	<0.61
13/02/2024	B	First leg	Econoliser	1	37	91	0	0	<0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	1	38	91	0	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	2	39	91	13	1	1.83	0	<0.61
13/02/2024	B	First leg	Econoliser	2	40	91	1	0	4.27	0	<0.61
13/02/2024	B	First leg	Econoliser	2	41	91	1	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	2	42	91	2	0	4.88	0	<0.61
13/02/2024	B	First leg	Econoliser	2	43	91	0	0	1.83	0	<0.61
13/02/2024	B	First leg	Econoliser	2	44	91	0	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	2	45	91	1	0	15.24	0	<0.61
13/02/2024	B	First leg	Econoliser	2	46	91	1	0	<0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	2	47	91	0	0	0.61	0	<0.61
13/02/2024	B	First leg	Econoliser	2	48	91	1	0	2.44	0	<0.61
13/02/2024	B	First leg	Econoliser	2	49	91	3	0	12.20	0	<0.61

25

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
13/02/2024	B	First leg	Econoliser	2	50	91	0	0	10.37	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	51	91	1	0	0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	52	91	7	0	0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	53	91	32	1	1.22	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	54	91	1	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	55	91	2	0	0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	56	91	3	0	1.83	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	57	91	1	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	58	91	1	0	1.22	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	59	91	0	0	2.44	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	60	91	4	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	61	91	17	1	0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	62	91	1	0	0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	1	63	91	2	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	64	91	16	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	65	91	63	0	3.66	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	66	91	4	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	67	91	87	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	68	91	0	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	69	91	0	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	70	91	0	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	71	91	4	0	57.32	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	72	91	45	0	12.80	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	73	91	6	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	74	91	0	0	0.61	0	<0.61
13/02/2024	B	Bunging	Steriliser	2	75	91	0	0	26.83	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	76	91	4	0	3.66	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	77	91	2	0	0.61	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	78	91	7	0	0.61	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	79	91	1	0	4.27	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	80	91	0	0	2.44	0	<0.61

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
13/02/2024	B	Bunging	Econoliser	1	81	91	0	0	11.59	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	82	91	0	0	15.24	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	83	91	7	0	25.61	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	84	91	0	0	23.17	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	85	91	2	0	0.61	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	86	91	1	0	1.83	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	87	91	0	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Econoliser	1	88	91	0	0	4.27	0	<0.61
13/02/2024	B	Bunging	Econoliser	2	89	91	0	0	1219.51	2	1.22
13/02/2024	B	Bunging	Econoliser	2	90	91	3	0	1219.51	6	3.66
13/02/2024	B	Bunging	Econoliser	2	91	91	1	0	1219.51	4	2.44
13/02/2024	B	Bunging	Econoliser	2	92	91	6	0	1219.51	7	4.27
13/02/2024	B	Bunging	Econoliser	2	93	91	6	0	3.66	0	<0.61
13/02/2024	B	Bunging	Econoliser	2	94	91	2	0	0.61	0	<0.61
13/02/2024	B	Bunging	Econoliser	2	95	91	6	0	31.10	0	<0.61
13/02/2024	B	Bunging	Econoliser	2	96	91	0	0	1.22	0	<0.61
13/02/2024	B	Bunging	Econoliser	2	97	91	0	0	<0.61	0	<0.61
13/02/2024	B	Bunging	Econoliser	2	98	91	61	1	9.15	0	<0.61
13/02/2024	B	Bunging	Econoliser	2	99	91	5	0	3.05	0	<0.61
13/02/2024	B	Bunging	Econoliser	2	100	91	3	0	2.44	0	<0.61
14/02/2024	C	Y-cut	Steriliser	1	1	97	33	0	0.55	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	2	97	49	0	<0.27	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	3	97	17	1	1.37	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	4	97	41	0	1.37	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	5	97	63	0	0.27	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	6	97	30	0	1.65	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	7	97	23	1	<0.27	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	8	97	32	0	<0.27	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	9	97	51	0	<0.27	0	<0.27
14/02/2024	C	Y-cut	Steriliser	1	10	97	39	0	0.27	0	<0.27
14/02/2024	C	Y-cut	Steriliser	2	11	97	18	1	<0.27	0	<0.27

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
14/02/2024	C	Y-cut	Steriliser	2	12	97	63	0	0.55	0	<0.27
14/02/2024	C	Y-cut	Steriliser	2	13	97	58	0	<0.27	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	14	97	16	1	<0.27	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	15	97	10	1	1.92	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	16	97	58	1	0.27	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	17	97	61	0	0.55	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	18	97	10	1	0.27	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	19	97	61	0	0.82	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	20	97	47	0	0.27	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	21	97	56	0	0.82	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	22	97	39	0	0.82	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	23	97	64	1	0.27	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	24	97	75	0	<0.27	0	<0.27
15/02/2024	C	Y-cut	Steriliser	2	25	97	49	0	0.55	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	26	97	21	0	0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	27	97	10	0	<0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	28	97	6	0	<0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	29	97	10	0	0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	30	97	31	0	<0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	31	97	4	0	<0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	32	97	5	0	<0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	33	97	13	0	1.10	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	34	97	3	0	22.80	0	<0.27
14/02/2024	C	Y-cut	Econoliser	1	35	97	5	0	0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	2	36	97	32	0	0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	2	37	97	25	1	<0.27	0	<0.27
14/02/2024	C	Y-cut	Econoliser	2	38	97	43	0	<0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	39	97	46	0	35.71	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	40	97	22	0	0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	41	97	29	0	0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	42	97	12	0	0.55	0	<0.27

28

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
15/02/2024	C	Y-cut	Econoliser	2	43	97	13	0	<0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	44	97	11	0	<0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	45	97	19	0	0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	46	97	8	0	0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	47	97	5	0	<0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	48	97	11	0	0.27	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	49	97	17	0	0.82	0	<0.27
15/02/2024	C	Y-cut	Econoliser	2	50	97	32	0	<0.27	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	51	54	38	0	0.27	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	52	54	4	0	1.92	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	53	54	8	0	87.91	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	54	54	1	0	0.27	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	55	54	3	0	0.55	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	56	54	1	0	0.82	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	57	54	4	0	0.27	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	58	54	1	0	0.27	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	59	54	16	0	<0.27	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	60	54	51	0	1.10	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	61	54	2	0	46.70	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	62	54	4	0	0.27	0	<0.27
14/02/2024	C	Retain rail	Steriliser	1	63	54	15	0	0.55	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	64	54	9	0	4.40	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	65	54	7	0	17.31	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	66	54	8	0	1.10	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	67	54	103	0	23.90	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	68	54	3	0	<0.27	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	69	54	2	0	<0.27	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	70	54	1	0	<0.27	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	71	54	15	0	1.10	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	72	54	9	0	12.36	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	73	54	27	0	1.65	0	<0.27

Date	Plant	Station	Equipment	Set	Sample	Area	APC plate	Dilution	APC per cm2	EC plate	EC per cm2
15/02/2024	C	Retain rail	Steriliser	2	74	54	15	0	<0.27	0	<0.27
15/02/2024	C	Retain rail	Steriliser	2	75	54	5	0	<0.27	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	76	54	31	0	1.10	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	77	54	0	0	0.55	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	78	54	13	0	1.92	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	79	54	2	0	0.27	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	80	54	3	0	<0.27	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	81	54	0	0	<0.27	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	82	54	5	0	<0.27	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	83	54	2	0	1.92	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	84	54	0	0	<0.27	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	85	54	0	0	0.55	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	86	54	1	0	0.27	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	87	54	0	0	<0.27	0	<0.27
14/02/2024	C	Retain rail	Econoliser	1	88	54	0	0	<0.27	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	89	54	47	0	<0.27	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	90	54	1	0	0.82	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	91	54	1	0	0.27	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	92	54	0	0	1.65	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	93	54	5	0	1.65	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	94	54	2	0	0.55	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	95	54	5	0	1.65	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	96	54	1	0	<0.27	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	97	54	6	0	<0.27	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	98	54	0	0	167.58	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	99	54	0	0	1.37	0	<0.27
15/02/2024	C	Retain rail	Econoliser	2	100	54	4	0	0.82	0	<0.27

Appendix 2: AMPC News Article

A new tool for sanitising knives has delivered huge savings on water, energy and emissions during in-plant trials and evaluation by the South Australian Research and Development Institute.

AMPC-funded trials in March and April at three plants – two processing cattle and one processing sheep – demonstrated the Econoliser was equivalent to traditional sterilisers at several stations, but with greatly reduced operational costs. The current constant flow steriliser is a pot that keeps water at a minimum temperature of 82°C and overflows at a rate of four to eight litres per minute. By contrast, the new Econoliser uses about 140mL per cleaning cycle for a pre-rinsed knife, delivering a 4.5 second spray of water at 35psi that is hotter than 82°C.

A comparison of estimated annual running costs for the two systems in an infrequent use steriliser setting, such as the carton meat assessment table in the boning room, showed potable water and energy bills were 99 per cent lower with the Econoliser and it generated 99 per cent fewer tonnes of carbon dioxide emissions.

Cost	Current system	Econoliser	Savings
Water	$2,025	$1	$2,024
Energy	$14,365	$41	$14,324
CO_2 emissions	13.2 tonnes	0.1 tonnes	13.1 tonnes

Estimated payback time for a unit is six months, depending on location and frequency of use.

AMPC Program Manager Matt Deegan said operators at one of the plants that took part in the trial were so impressed by the results that they adopted an Econoliser unit permanently and have successfully gained federal government approval for its use.

This provides a pathway for potential national approval by the Department of Agriculture, Fisheries and Forestry which would make broadscale adoption easier, and opens the door for other sterilising units from Econoliser manufacturer Airtech Distribution Ltd., such as for saws and cutters.

“Reducing potable water consumption and energy for heating water are really important because energy translates to emissions,” Matt says.

“And living in Australia we all need to find ways to be more efficient with water.”

Matt says red meat customers in Australia and overseas, including supermarket chains and multinational corporations, were all looking to their supply chains for improvements in resource efficiency.

“That flows through to everyone that makes food, across the whole of agriculture and food processing,” he says.

A recording of a project webinar held in April can be viewed at https://www.youtube.com/watch?v=EIO-WqtJYU0

A final report on the research is due in September.

Contact m.deegan@ampc.com.au for more information.

Appendix 3: A protocol for verifying the installation and operation of Econoliser units in Australian abattoirs

The corresponding document has been enclosed separately with this report.