

Eco Flow

Novel 'Waste Reducing' Eco Flow Packaging

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Contents

Contents	2
1.0 Executive Summary	3
2.0 Introduction	4
3.0 Project Objectives	4
4.0 Methodology	5
5.0 Project Outcomes	5
5.1 Validation Trials	5
5.2 Sustainability Claims	6
5.3 Consumer Acceptance	8
5.4 Processing	8
6.0 Discussion	9
6.1 Validations	9
6.2 Sustainability	9
6.3 Consumer Acceptance	9
6.4 Processing	10
7.0 Conclusions	10

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1.0 Executive Summary

Bindaree Food Group (BFG) have sustainability goals that include reducing the amount of plastic utilised and delivered into the retail market. They have invested in re-furbishing their Gold Coast factory to maintain state of the art retail packing and are committed to driving sustainable packaging methods to meet and exceed their customer requirements as well as Australian Packaging Covenant Organisation (APCO) targets.

Various BFG customers have requested further investigation and development work on improved sustainable packaging options. Whilst significant work is being carried out in the industry to improve the recyclability status of plastics used in meat packaging, BFG believes there is an opportunity to reduce the volume of plastics entering the retail market. The adoption of flow wrap packaging for mince products has the potential to meet both these areas.

Flow wrap packaging is available in the dairy and fresh produce industries however is novel to meat packaging in Australia. It involves forming a plastic film pouch around a food product, in this case a mince portion, gas flushing and sealing to provide a tamper resistant pillow pack. Flow wrap product launches carried out by European retail meat manufacturers have seen a reduction in plastic use by up to 70%. Other benefits include a reduction in carbon emissions due to a smaller shipper footprint and weight reducing the number of freight movements.

The purpose of the Eco Flow project was to validate flow wrap packaging technology for beef mince products and test the product in the Australian market for consumer acceptance. The project was carried out at the BFG, Burleigh Heads retail ready packing site.

BFG installed a loan FM300 horizontal form fill seal (HFFS) flow wrap machine from Ulma for the purposes of carrying out feasibility trials. These trials included shelf-life validations on beef mince and results showed a shelf-life gain of 1 day using this technology compared with the incumbent rigid tray and film. Proof of concept samples were also shared with customers with a major retailer committing to store trials in Queensland.

Ulma and BFG then commissioned a larger HFFS FM500 machine with further trials on various film types carried out. A printed KPET film was used to launch the product into the retail market. An APCO V2 2025 compliant BOPP film has also been validated and will be launched in late 2024. When considering the APCO 2025 targets for recyclability and reduction in plastic use, this packaging innovation has met the brief. The film is 70% less plastic compared to the incumbent rigid tray and film and does not require a label which reduces the risk of recycling contamination from a label, paper or otherwise.

Other sustainability features have included increased number of packs per carton reducing freight and refrigeration energy use. A Life Cycle Analysis (LCA) has also shown significant carbon emissions improvements for the BOPP film if recycled in mechanical soft plastics recycling schemes.

The FM500 horizontal flow wrap machine from Ulma was easily integrated with a traditional mince grinding and portioning line and has been straight forward to maintain from a reliability perspective. Operationally the FM500 flow wrap machine is easy to use compared with current tray sealing technology. Processing speeds were tested at 120 packs per minute.

Flow wrap film waste was seen to be as low as 3%. This is significantly lower than the current waste factor for standard tray sealing packaging. Waste should only be seen at start up, with minimal waste during roll changeover.

Flow wrapped mince product has been trialled in the retail market with mostly positive consumer feedback. With the introduction of an APCO 2025 V2 compliant BOPP film and the development of soft plastics recycling infrastructure flow wrap packaging of mince can provide a more sustainable packaging option compared to the incumbent packaging.

2.0 Introduction

Bindaree Food Group (BFG) have engaged in several projects that aim to refine and reduce their carbon footprint by limiting the amount of plastic utilised and delivered into the retail market. They have invested significant monies in re-furbishing their Gold Coast factory to maintain state of the art retail packing and are committed to driving sustainable packaging methods to meet and exceed their customer requirements as well as Australian Packaging Covenant Organisation (APCO) targets.

Various BFG customers have requested further investigation and development work on improved sustainable packaging options. Whilst significant work is being carried out in the industry to improve the recyclability status of plastics used in meat packaging, BFG believes there is an opportunity to reduce the volume of plastics entering both the waste and recyclability streams through product and process optimisation. The adoption of flow wrap packaging for mince products has the potential to meet both these areas.

Flow wrap packaging is available in the dairy and fresh produce industries however is novel to meat packaging in Australia. It involves forming a plastic film pouch around a food product, in this case a mince portion, gas flushing and sealing to provide a tamper resistant pillow pack. Product launches carried out by European retail meat manufacturers have seen a reduction in plastic use by up to 70%. Equipment suppliers have also suggested there are no adverse effects on product shelf life compared with current modified atmosphere packaged (MAP) products. Other benefits include a reduction in CO2 emissions due to a smaller shipper footprint and weight and therefore less freight movements as well as a reduction in energy required to refrigerate finished goods due to an increased number of packs per carton.

The purpose of the Eco Flow project was to validate flow wrap packaging technology for beef mince products and test the product in the Australian market for consumer acceptance. The project was carried out at the Bindaree Food Group, Burleigh Heads retail ready packing site.

3.0 Project Objectives

- Reduce the amount of plastic used in retail packaging.
- Develop a brand-new concept in fresh meat packaging.
- Speed up the number of packs produced compared to current throughputs.
- Reduce the number of labels put onto packaging by using printed films.
- Explore alternative shipper sizes due to flexible packaging, improving OM's and therefore reducing freight and OPEX costs.
- Reduce carbon emissions through reduced freight movements and energy use in packaging in finished product storage.
- Provide the retail meat industry with a novel packaging method meeting sustainable packaging policies and targets.

4.0 Methodology

To achieve the project objectives the project methodology detailed below was executed.

1. Complete feasibility study and shelf-life validations.
2. Prepare current processing line for commissioning of Flow Wrap Machine (downhill line speed hands free/minimal human intervention).
3. Install Flow Wrap Machine and commence commercial trials.
4. Run to maximum, recording plastic waste, line speed and rejects. Perform comparison analysis of plastic use with incumbent packaging.
5. Work with film supplier to develop printed film. Store trials with current retail customers.

5.0 Project Outcomes

5.1 Validation Trials

5.1.1 Commissioning

A loan FM300 flow wrap machine from Ulma was installed in a separate processing area to the main processing room and served the function of feasibility assessments and shelf-life validations which is detailed further below. Multiple iterations of film structures and other attributes (antifog, gas quantities, printed film design etc.) were also tested ensuring APCO and customer expectations were considered.

The Ulma FM500 was then commissioned and subsequent trials found that there were differences in the function and design of the equipment compared to the FM300. Larger production trials were conducted and flow wrapped product subjected to transport and display testing to challenge the product throughout different aspects of the supply chain.

The Ulma FM500 and mince grinding and portioning systems were easily integrated and a Videojet inkjet system was installed and commissioned to produce date marking on the film.

5.1.2 Shelf life and Transport Trials

Shelf-life testing validations were carried out according to customer testing protocols. During validation trials on the FM300 a 500g flow wrap beef mince product was produced with a shelf life the same as the incumbent. Samples were subsequently provided to our customer for proof-of-concept review (Image 1). After receipt of the FM500 machine the product was re-validated using several non-printed films with an extended shelf-life outcome.



Image 1 – Proof-of-concept flow wrap plain film packs in carton

Transport trials were completed with the results indicating work needing to be done on portion integrity and pack sealing.

5.1.3 Film

A KPET film was validated and trialled successfully. This film complied with the current APCO requirements. Films from other suppliers were also trialled and validated. All films were considered suitable however local supply was favoured over international supply due global logistics and supply chain issues caused by COVID. Printed films were also trialled and validated with no issues.

5.2 Sustainability Claims

5.2.1 Film type and Recyclability

Various film types were trialled during the validation and commissioning processes. BFG decided to use a local supplier, due to the COVID induced supply chain challenges that were affecting global logistics. A film structure consisting mostly of KPET was initially launched. This film met APCO standards however it was acknowledged that further development of a BOPP film would be required to meet APCO 2025 V2 soft plastics standards. A BOPP film has since been trialled and validated for launch in late 2024.

5.2.2 Life Cycle Analysis

The film supplier performed a Life Cycle Analysis (LCA) for flow wrap packaging in BOPP film format. The BOPP film complying with APCO 2025 targets can be recycled. Two analyses were performed. One analysis was conducted for a retailer who at the time did not have access to the Redcycle or similar soft plastics recycling scheme (Figure 1) and assumed the plastic would be disposed of by the end user in waste to landfill. The second analysis (Figure 2) was completed for a retailer involved in the Redcycle, return to store soft plastics recycling scheme and assumes the collected soft plastics are mechanically recycled. In both cases the flow wrap packaging (proposed packaging) is compared with the current packaging format of a rigid PP tray and high shrink film (baseline packaging).

Figure 1. LCA Result for BOPP film not collected in Redcycle soft plastics recycling stream.

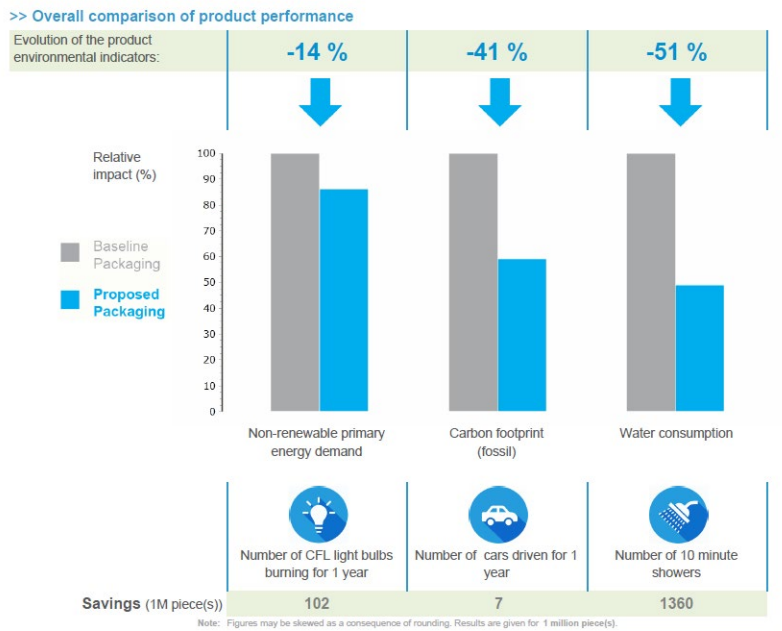
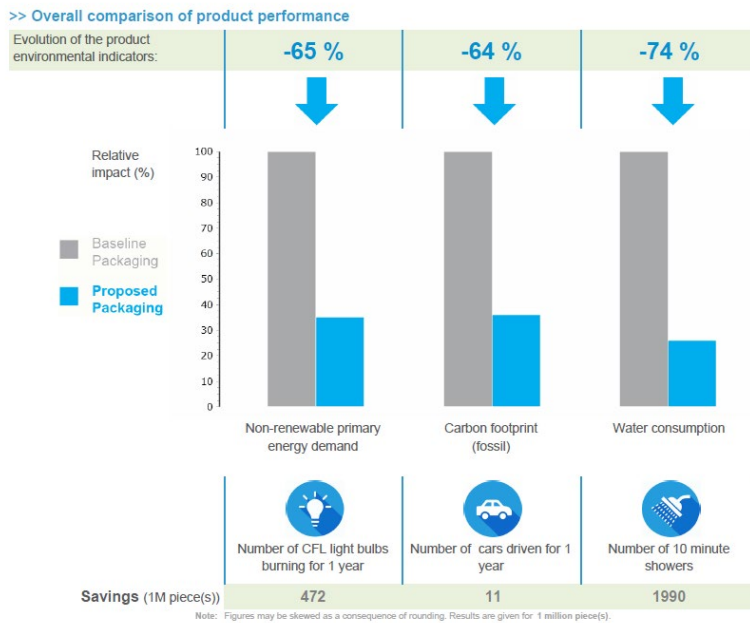


Figure 2. LCA result for BOPP film collected in Redcycle soft plastics recycling stream.



5.2.3 Plastic Reduction

The analysis of plastics reduction was calculated as the difference in plastic weight of a 500g mince portion in flow wrap compared with the incumbent rigid tray and film. The process waste for both packaging types was not considered in this calculation. For the product launched into the market the plastic reduction was calculated at more than 70% and verified by the plastic supplier.

5.3 Consumer Acceptance

BFG's major customer, approved a commercial trial of flow wrap beef mince product to Queensland stores in December 2022. The purpose of the trial was to determine whether consumers would continue to purchase a product in different packaging. The results showed there was very little change in sales and mostly positive feedback from customers in social media. After 3 months in store, major media outlets also reported on the positive aspects of flow wrap mince in the Queensland stores:

The success of flow wrap in the beef mince prompted the retailer to trial further mince products in flow wrap packaging in early 2024.

The flow wrap packaging also gained recognition as an innovative packaging solution at the 2023 Australian Packaging Awards, being named finalist in the Innovative Packaging Awards section.

5.4 Processing

5.4.1 Line Set-Up

The flow wrap process was set-up in a separate processing area to ensure there were no interruptions to normal production. The final line consisted of a full mince grinding, portioning, packing, check weighing, carton packing and labelling system. Gas was sourced from Air Liquide and had to be plumbed to the line from separate tank banks located in the carpark area outside the processing area. All equivalent quality assurance and control systems were implemented for product launch.

5.4.2 Line Speed

Processing speeds were limited to 85 packs per minute (ppm) during trials due to the lack of automation of meat being delivered to the line as well as cartons of finished product being labelled off the line. A packing rate of 120ppm however was achieved on the FM500 at various times during trials.

5.4.3 Film waste

The factors affecting film waste include; line start-up (Image 2), roll change and stoppages. Line stoppages cause damage to fin seals due to the film sitting on the heated rollers for excessive periods.



Image 2 - Start-up film waste

5.4.4 Maintenance and Cleaning

There have been very few maintenance and reliability issues with the Ulma FM500. Early sequencing and therefore meat in end seal issues were caused by the mince portioner performing inconsistently and the FM500 needing to stop and start conveyors to ensure sequencing at the sealing jaws was consistent. A fault was repaired on the portioner and there have since been no issues. A couple of sensors have also needed replacing and it is believed this may have been due to water ingress during cleaning. A film roller arm has also been bent during production where inexperienced operators have pulled on film to wind it on rather than using the automatic feed function. Servicing has been carried out according to the schedule with few repairs required.

The entry conveyor can be moved from the main machine which allows for meat contact surfaces to be cleaned appropriately. All sensors however need to be kept covered. If mince portions are the correct size and the machine conveyors, guides and film rollers have been set-up and aligned accordingly little meat or contamination is needed to be removed from inside the machine. The main machine will not tolerate water.

6.0 Discussion

6.1 Validations

The flow wrap machine was easily installed and integrated with front of line (grinding and forming) and end of line (metal detection and check weighing) equipment.

The reason for an extra day shelf life compared with the incumbent packaging has not been elucidated. The flow wrap equipment uses gas flushing as opposed to the modified atmosphere system used on tray sealers. It is suggested this, a higher gas pressure in the pack and a shorter portion to pack distance could have an influence on shelf life.

Significant trial work was completed to find the best settings and temperatures for film sealing and cutting. It was noted both BOPP and KPET films were not tolerant of pleats in seals which resulted in flat packs from gas leakage.

6.2 Sustainability

When considering the APCO 2025 targets for recyclability and reduction in plastic use, this packaging innovation has met the brief. The film is 70% less plastic compared to the incumbent rigid tray and film and does not require a label which reduces the risk of recycling contamination from a label, paper or otherwise. With the introduction of an APCO 2025 V2 compliant film and the development of soft plastics recycling infrastructure flow wrap packaging of mince provides a more sustainable packaging option compared to the incumbent packaging.

Further work could be undertaken to use the LCA data and carbon emissions reduction aspect of the packaging for marketing purposes.

6.3 Consumer Acceptance

During early transport and handling trials there were initial concerns regarding product integrity during transport and handling especially on shelf, in store. Market reviews have shown that the product stands up to handling by consumers. Consumer acceptance was better than expected.

6.4 Processing

Operationally the FM500 flow wrap machine is easy to use and maintain when compared with current tray sealing technology. Processing speeds were tested at 120 packs per minute which is comparable if not better than the packing speeds currently being obtained on the current 'high speed' mince tray sealing lines. Although the packs are conveyed through a check weigh system, removing the pack labelling requirement also assists with the improved line speeds.

Flow wrap film waste during processing was seen to be as low as 3% due to there being no need to cut out the film through the process. This is significantly lower than the current waste factor for standard tray sealing packaging. Waste should only be seen at start up, with minimal waste during roll changeover.

7.0 Conclusions

After successful commissioning, validation trials and commercial launch, flow wrap has proven to be a beneficial packaging format that reduces plastic from entering the Australian market. At the completion of this project flow wrap is still in trial in Queensland with steady sales and a 70% reduction in plastic compared with the incumbent rigid tray and film packaging for this product type.

The film is printed and therefore reduces the need to add a label to the pack, improving both recyclability and assisting with processing speeds exceeding those on the current tray sealing lines. Other sustainability features have included increased number of packs per carton reducing freight and refrigeration energy use. A Life Cycle Analysis (LCA) has also shown significant carbon emissions improvements for the BOPP film if recycled in mechanical soft plastics recycling schemes.

The FM500 horizontal flow wrap machine from Ulma was easily integrated with a traditional mince grinding and portioning line and has been straight forward to maintain from a reliability perspective.