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Life cycle assessment of Food Recycle's food-waste-to-feed pathway and Cool Bin Collection System

Summary of Edge Impact's work for Food Recycle Ltd, 2020 to 2026

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1. Purpose

This paper summarises the two life cycle assessments Edge Impact has completed for Food Recycle Ltd, what the results show about the carbon performance of converting commercial food waste into animal feed and of the Cool Bin Collection System that supplies it, and what a full-scale facility at Goulburn would mean for NSW. It accompanies Food Recycle's Unsolicited Proposal to the NSW Government.

2. Key points

- **Edge Impact has been Food Recycle's independent LCA practitioner since 2020.** Both studies follow ISO 14040 and ISO 14044, were modelled in SimaPro on the Australian AusLCI database with ecoinvent and Agri-footprint filling gaps and were commissioned commercially. Edge holds no interest in Food Recycle or the proposed facility.
- **Landfill is the problem to solve.** A tonne of commercial food waste sent to landfill generates 1,095 kg CO₂e net, even with 65% landfill gas capture. Every recovery pathway assessed, including Food Recycle's, returns a net negative result.
- **Food-waste-to-feed is the lowest-emitting treatment process of the four assessed.** At 49 kg CO₂e per tonne before credits it sits well below composting (119) and anaerobic digestion (106), because the process dehydrates the waste rather than letting it decompose, so there are no significant direct methane or nitrous oxide emissions.
- **The feed itself outperforms conventional feed.** The 2021 study found Food Recycle's poultry feed had lower impacts than a nutritionally equivalent conventional formulation across all five indicators assessed, and that using it could cut the carbon footprint of chicken meat by at least 25% and of eggs by around 76%. That study deliberately excluded any credit for avoided landfill, so the result is conservative.
- **The Cool Bin Collection System's footprint is almost entirely electricity.** Freezer operation, bin washing and battery-electric trucks account for close to all of it. On today's NSW grid it sits above conventional diesel collection, at 84 - 101 against 63 - 67 kg CO₂e per tonne collected. That gap is under 2% of the difference between landfill and food-waste-to-feed. It closes substantially under the 2030 and 2050 NSW grid scenarios, and it can be removed today with renewable supply. A diesel fleet has no equivalent path.
- **Embodied carbon of the freezer bins is not a material factor.** Six to eight kg CO₂e per tonne collected on a conservative five-year service life, with material production making up 97% of that.

3. Edge Impact's role and the relationship with Food Recycle

Edge Impact has been Food Recycle's life cycle assessment practitioner since 2020. I founded Edge in 2008 and led it as CEO until 2024, and I remain a Co-Founder and Senior Advisor. The 2021 study was approved under my name as CEO; the 2026 study was delivered by Edge's Senior Consultant Yumi Kobayashi with my technical review.

Both engagements were commercial. Food Recycle commissioned and paid for the work. Edge Impact holds no equity, revenue share or other interest in Food Recycle, its co-operative or the proposed Goulburn facility, and the results were not adjusted to suit the client. Where a methodological choice was open, the conservative option was taken and documented. The clearest example is the 2021 decision to exclude the avoided-landfill credit, which would have added close to 4 tonnes of CO₂e per tonne of feed to Food Recycle's result. CSIRO took the same conservative position in its aquafeed assessment, which makes the two bodies of evidence directly comparable.

Across both studies, Edge's contribution comprised:

- **Goal and scope definition** with Food Recycle, including functional units, system boundaries and the choice of comparison systems.
- **Primary data collection** using structured request templates, with each dataset checked for completeness and plausibility against public benchmarks before use.
- **Life cycle modelling** in SimaPro against AusLCI, ecoinvent and Agri-footprint, with database selection documented and Australian data preferred wherever it exists.
- **Impact assessment** using ReCiPe 2016 across five indicators in 2021, and IPCC AR6 GWP100 in 2026.
- **Sensitivity and scenario analysis** on the parameters that carry the result: bin fill rates, vehicle energy use, methane leakage, grid decarbonisation, electrification of the conventional fleet, and collection frequency.
- **Internal peer review and reporting** to a standard that can be audited to inventory level by a third party.

4. The 2021 study: food-waste-to-feed

The 2021 assessment took a cradle-to-gate view of one tonne of Food Recycle poultry feed with a defined nutrient content, from collection of the food waste to the bagged pellet at the factory gate. It was compared with a nutritionally equivalent conventional layer feed, mostly wheat, soybean meal and canola meal, formulated by Food Recycle's partners at the University of New England. A second comparison looked at the treatment of one tonne of wet food waste through Food Recycle's process against composting and anaerobic digestion.

Food Recycle's feed had a lower impact than the conventional feed on all five indicators: greenhouse gas emissions, freshwater eutrophication, land use, fossil resource scarcity and water consumption. The benefit comes almost entirely from not growing wheat and soy. Feed is about 35% of the carbon footprint of chicken meat and about 76% of the footprint of eggs (Bengtsson & Seddon 2013; Quantis 2020), so on the assumption that Food Recycle's feed performs equivalently in the bird, which Food Recycle's University of New England trials support, the footprint of chicken meat could fall by at least 25% and of eggs by around 76%.

As a treatment pathway, Food Recycle's process had lower greenhouse gas and eutrophication impacts than composting or anaerobic digestion, because it produces no direct emissions from decomposition. Its land use and water use were higher, the water result being embodied water in Australian renewable generation rather than water used in the process. The main hotspots inside the process were feed packaging and the micronutrients added to the mix, both of which Food Recycle has since been working to reduce.

5. The 2026 study: the Cool Bin Collection System

Since 2021 Food Recycle has redesigned how it collects. Insulated 210 L and 500 L freezer bins at the generator's premises freeze the waste as it is deposited. Fill-level sensors trigger collection only when a bin is full. Battery-electric rigid trucks exchange full bins for clean ones, consolidate at Campbelltown, and a battery-electric prime mover carries the bins to Goulburn for processing. The 2026 study brought this whole logistics chain into scope, along with the embodied carbon of the bins, and updated the treatment comparison. Three linked assessments were run, all on IPCC AR6 GWP100:

Assessment	Basis	Before credits	Net (with credits)
Treatment: Food Recycle food-waste-to-feed	per t treated	49	-161
Treatment: composting (windrow)	per t treated	119	-72
Treatment: anaerobic digestion	per t treated	106	-370
Treatment: landfill (65% gas capture)	per t treated	1,162	1,095
Collection: Cool Bin system, 500 L / 210 L	per t collected	84 / 101	n/a
Collection: conventional diesel, 660 L / 240 L	per t collected	63 / 67	n/a
Embodied carbon: freezer bins, 210 L / 500 L	per t collected	6.2 / 8.0	n/a

All figures kg CO₂e per tonne of food waste. Source: Edge Impact, Comparative Life Cycle Assessment for Food Recycle, draft V0.6, September 2026. Landfill credit is electricity generated from captured gas; anaerobic digestion credit is displaced grid electricity, heat and fertiliser; food-waste-to-feed credit is displaced conventional feed ingredients.

What the treatment results show

The gap that matters is between landfill and everything else. Landfill at 1,095 kg CO₂e net sits 1,256 kg above food-waste-to-feed and 1,474 kg above anaerobic digestion. Among the recovery pathways, food-waste-to-feed carries the smallest process burden of the four, and it is the only one with no significant direct emissions to air. Anaerobic digestion reaches a lower net figure once credits are included, because its biogas displaces grid electricity and heat. That credit is a function of how carbon-intensive the displaced electricity is, and it will shrink as the NSW grid decarbonises. Food Recycle's credit, displaced wheat and soy, does not depend on the grid.

What the collection results show

Electrifying the trucks works: truck operation falls from 56 kg CO₂e per tonne on diesel to 17 to 29 on the battery-electric fleet. What the conventional system does not carry, and Food Recycle does, is the electricity to run the freezers, the electricity for the mechanical bin wash, and the Campbelltown-to-Goulburn transfer leg. On today's NSW grid those three outweigh the truck saving, which is why the collection stage as currently configured sits 20 to 35 kg CO₂e per tonne above conventional collection.

Three things put that number in proportion. First, it is less than 2% of the 1,256 kg difference between landfill and food-waste-to-feed, so a tonne handled end to end by Food Recycle returns around -77 kg CO₂e against 1,158 for the same tonne collected conventionally and landfilled. Second, almost all of Food Recycle's collection footprint is electricity, so under the AEMO 2030 and 2050 NSW grid scenarios it falls substantially with no change to the operation, and with a renewable electricity supply it can be brought close to the embodied-vehicle floor today. Third, the report's collection-frequency scenario shows that where a conventional operator drives a fixed route daily or three times a week and Food Recycle drives it once, because frozen waste does not need frequent removal, collection frequency has a significant effect on emissions per tonne. That is the mechanism behind the Cool Bin system, and the baseline comparison does not yet fully capture it, because public data on how conventional operators run their routes is thin.

6. Benefits to the NSW Government and the State of NSW

- **Landfill diversion with a number attached.** Each tonne of commercial food waste diverted from landfill avoids on the order of 1,100 kg CO₂e of biogenic methane. NSW is moving to mandate source separation of commercial food waste. Once the material is separated, the question is where it goes, and food-waste-to-feed is the lowest-process-emission destination assessed and the only one that returns the material to the food system as a nutrient input rather than a soil amendment or a fuel.
- **A claim the Government can stand behind.** Public support for a proposal on environmental grounds is only as safe as the numbers underneath it. These results are ISO 14040/44 compliant, built on Australian inventory data, documented to the level a third party can audit, and conservative by construction. Where data was missing, assumptions were chosen against Food Recycle's interest and tested in sensitivity analysis.
- **Regional processing capability in Goulburn.** Food Recycle's plan puts the first facility in the Goulburn Mulwaree area with operation targeted for late 2027, and six food waste catchment areas across NSW and the ACT. That is processing, logistics and feed manufacturing employment in regional NSW, handling a waste stream that is today mostly trucked to metropolitan landfill.
- **Domestic feed security.** Feed is the dominant input cost and the dominant carbon input in poultry, pork and aquaculture production, and Australia imports a substantial share of the soybean meal and fishmeal it depends on. A domestic feed ingredient made from a waste stream reduces that exposure. CSIRO's aquafeed trials reach the same conclusion from the nutrition side.
- **Logistics that improve automatically with the grid.** Because the Cool Bin system's footprint is electricity rather than diesel, it is one of the few waste logistics models whose emissions fall in step with NSW's own grid transition, and which can be taken to near zero today by a procurement decision. No diesel fleet can make that claim.

7. Status and limitations

- **The 2026 report is at draft V0.6.** Internal review is complete and the results quoted here are not expected to change materially before final issue [CHECK date]. The 2021 report is final.
- **The 2026 study assesses a single indicator, GWP100.** The 2021 study covered five. Burden shifting to other categories has not been assessed for the collection system, and eutrophication is worth a look given the batteries and electronics involved.
- **The collection system is a planned configuration, not an operating one.** Vehicle specification, bin mix and route assumptions reflect Food Recycle's current plan. The conventional comparison relies on literature values for bin fill, wash practice and haul distance because operators do not publish route-level data, and those assumptions carry the collection-stage result. Edge Impact will update the model with measured data once the Goulburn facility is running.

I am available to the NSW Government to discuss the method, the data or the results.



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