

The Path to Half

Solutions to halve Victoria's
food waste by 2030



The Path to half
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Introduction

Victorians are justifiably proud of our food and drink culture. We enjoy a thriving coffee culture and cafes and restaurants to suit every occasion. We grow one-quarter of all fresh food in Australia and process over half of all Australian-made foods. Our food and drink products are shipped globally, while our food and wine regions draw international and local tourism.

On the flipside, we are responsible for about one-quarter of Australia's food waste – that's 2.4 million tonnes of food each year that doesn't end up on our plates.

While some food waste is unavoidable, much of it is not. Food waste costs us a lot of money – about \$6 billion each year. It's also a big contributor to climate change and wasted water.

Victoria is now part of a global movement to halve food waste by 2030. Earlier this year, we reaffirmed our commitment to meet this target in Recycling Victoria, Victoria's first circular economy policy and action plan.

The Path to Half explains the true cost of food waste in Victoria and gives us the first ever Australian perspective on the impacts of food waste and food production on climate change, water loss and economic costs.

It lists food waste solutions from across the globe and their potential to reduce food waste and its impacts in Victoria. This gives us a clear picture of where to invest our efforts to get the best results from halving food waste.

Halving food waste by 2030 is an ambitious target and we all have a role to play. Together we can set Victoria on the path to half and ensure a fair, healthy, sustainable and equitable food future for all Victorians.



\$5,190



\$2,460



\$2,245



\$2,490



\$2,245



\$2,245



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Food waste in Victoria



Our vision:

Halve food waste in Victoria by 2030

Food waste is an issue, not just because of the quantities that end up in landfill, but because of the wasted energy and resources that went into producing, processing, transporting and cooking it.

What is the problem?

Victoria spends an estimated \$6 billion each year to grow, process, distribute, sell, buy and cook about 2.4 million tonnes of food that never makes it to the table.

This food waste is responsible for around 15 per cent of Victoria's non-energy greenhouse gas emissions and the loss of around 29 billion litres of water – enough to fill almost 12,000 Olympic-size swimming pools.

We are not alone. Across the globe, we are wasting an estimated 1.3 billion tonnes of food every year. That's about one-third of all the food produced for human consumption.¹

This report looks at the true impacts of food waste and prioritises the solutions that will set us on the path to halve food waste by 2030 – a path that considers all the interconnected impacts of reducing food waste. This helps us invest our time and resources in the areas that will give us the biggest impacts from halving food waste.

Food waste in Victoria

2.4m tonnes

of food waste each year

\$6bn

in estimated product value
and disposal costs per year

3.15m tonnes

of greenhouse gas emissions (CO₂e)

29bn litres

of water lost

Victoria produces about a quarter
of Australia's food and processes
close to a third of all Aussie made
food (by value).

We have the highest level of food
waste in Australia.

¹ Scottish Government, Food Waste reduction Action Plan, April 2019, available from www.gov.scot.

A global commitment to halve food waste

Across the globe, many countries have committed to halving food waste.

2015

193 United Nation member states agree to halve food waste by 2030.

2017

The Australian Government and all states commit to halve food waste by 2030, releasing the National Food Waste Strategy.

2019

The Australian Government releases the first National Food Waste Baseline, identifying opportunities for food waste reduction in Australia.

2020

The Australian Government releases the National Food Waste Roadmap.

The Victorian Government releases **Recycling Victoria: A new economy to move Victoria towards a circular economy**. Recycling Victoria will help deliver on the national target to halve Australia's food waste by 2030.

2021

Sustainability Victoria releases **The Path to Half: Solutions to halve Victoria's food waste by 2030** (this document), setting out the true cost of food waste in Victoria and food waste solutions.



By 2050, Australia's population could jump by 60 per cent to 36 million people. We need to make changes now to feed our future population.

We all have a role to play

With only 10 years to meet our food waste target, we need to get started on the path to half. All of us have a role to play in reducing food waste.

Government

- › Support and educate businesses and households to reduce food waste.
- › Explore policy and regulatory levers to support reducing food waste.
- › Monitor and report on food waste.
- › Connect supply chains and sectors by fostering an environment of innovation and collaboration to reduce food waste.

Research organisations

- › Partner with government and industry to research, develop and demonstrate food waste solutions.
- › Set targets to reduce food waste at their own facilities and campuses.

Businesses

- › Join initiatives to reduce food waste in their own businesses or come up with smart food waste solutions to reduce food waste along the supply chain.
- › Help others through small actions like buying and selling farmer-grade produce or offering take-home boxes for unfinished meals.

Not-for-profit organisations / community groups

- › Rescue and recover food before it becomes waste.
- › Educate businesses and households to reduce food waste.
- › These groups are critical to helping food-insecure Victorians to access fresh food, whether as fresh ingredients or pre-prepared meals.

Households

- › Take small and simple actions to reduce food waste like storing food correctly, checking the fridge and pantry to use up food before it goes off, meal planning before shopping and using up leftovers.
- › Choose odd-looking fruit and vegetables when shopping to support farmers and save money.

Understanding food waste

Food goes through an epic journey before it ends up on our plates – and food waste happens at every stage of this journey.

What is food waste?

Food waste includes any food or drink lost from any part of the food supply chain. It includes edible food – food that could be eaten but is thrown away instead, and inedible food – the bits that cannot be eaten (bones, coffee grounds) or are sometimes undesirable (skins and peels).

When we think of food waste, we usually think of food at the end of its journey – the food and drink in homes and restaurants that doesn't get eaten and ends up in the bin. But food waste is a problem all along the supply chain.

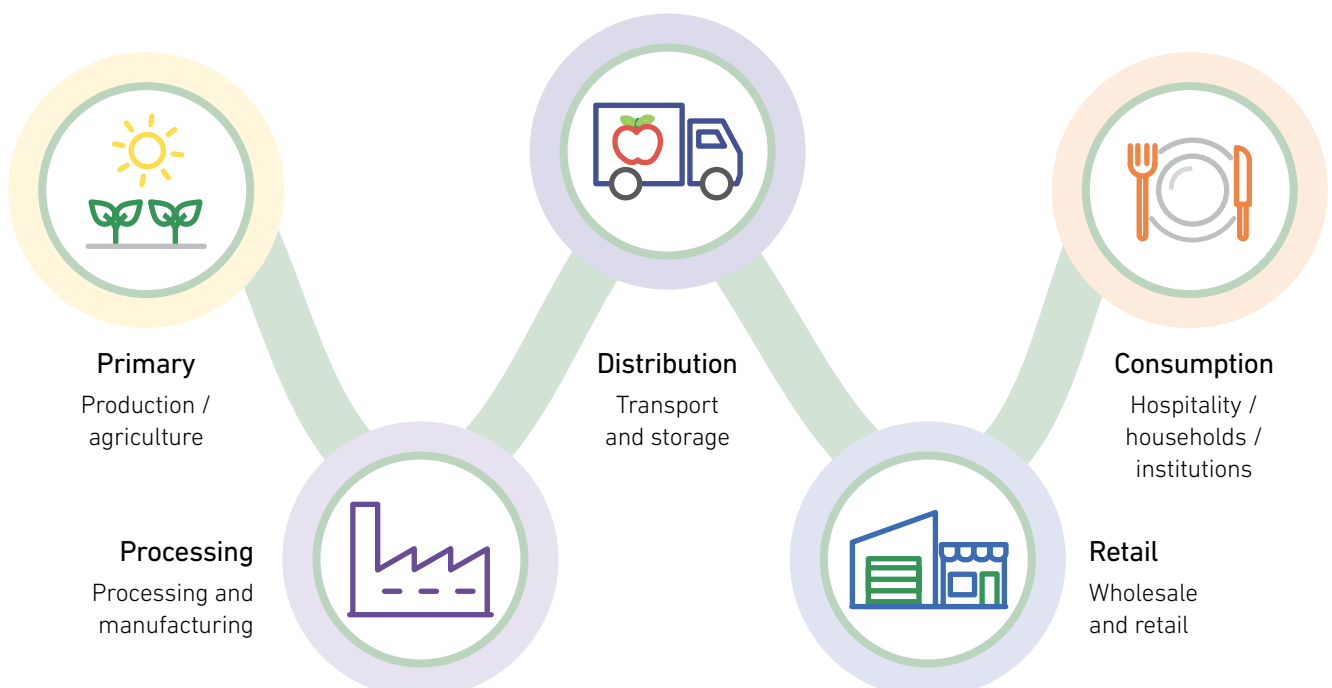
Why does food waste happen?

At primary production, crops might be discarded due to damage from pests, disease or weather, or not harvested after a fall in market prices. During processing, food loss can result from removing inedible or undesirable food parts or from damage during handling.

Inadequate temperature control can cause spoilage during distribution and stock management issues can lead to waste at the retail stage.

In hospitality and food service, food waste results from meal prep, plate waste and unsold meals. At home, sometimes we buy too much food, or we might not know how to safely eat and store leftovers.

The food supply chain – the journey from farm to fork



The true cost of food waste

Most food waste research looks at waste volumes. This is the first to measure the impact of food production and food waste in Victoria on climate change, water loss and the economy – and how these impacts change as food travels from farm to fork. Measuring these impacts gives us the true cost of food waste – the loss of the accumulated resources invested in food as it moves along the supply chain.



Waste volumes

How many tonnes of food waste occur across the supply chain?



Climate change

How many tonnes of greenhouse gases do we generate as food moves along the supply chain?



Water loss

How much water is used to grow and process food?



Economic costs

How much does it cost to produce, process, distribute and sell food?
How much does it cost to dispose of?

Prevention first

To tackle food waste, we always start here. For this reason, the Path to Half only proposes solutions focused on prevention.

These solutions are how Victoria will contribute to halving food waste by 2030.

Next best solutions

While preventing food waste is the best first step to reducing the impacts of waste, we can't always prevent it from happening. When we can't prevent food waste, we must try to maximise the recovery of its materials and energy.

Recycling Victoria: a new economy is a \$300 million policy supporting Victorians to prevent waste in the first instance, and to increase recovery of materials and energy from unavoidable waste.

Prevention

Reducing food waste, including raw materials, ingredients and products, through:

Products, processing and packaging

Turn processing waste into other products, get more products to consumers and help consumers enjoy those products for longer.

Efficient business operations and supply chain

Process foods more efficiently and keep food fresh as it moves from farm to fork.

Education and behaviour change

Help households and businesses take steps to reduce food waste.

Food rescue, recovery and donation

Redistribute surplus food and sell it at a discount or give it to people who are doing it tough.

Recycling

Food waste has a secondary use such as compost or fertiliser.

Recovery of energy

Energy from food waste is recovered such as through anaerobic digestion.

Disposal

Food waste is disposed to a waste destination with no treatment or recovery of resources, for example to landfill.

The impact of food waste

Food waste is a big problem. It contributes to climate change, wastes water and costs us money. The further food travels along the food supply chain, the more we lose when we throw it away.

By the time food reaches the consumer, climate, water and cost impacts have peaked. If it goes in the bin, we lose all the accumulated resources invested in growing, processing, distributing, selling, buying and cooking that food.

Food waste happens all along the food supply chain, but at different volumes and with varying impacts on climate change, water use and economic costs. Understanding these impacts gives us the true cost of food waste and shows us where to prioritise solutions to reduce food waste and minimise its environmental and cost impacts.




Where do we see the highest impacts from food waste?

Food waste happens all along the food supply chain, with the biggest volumes currently coming from processing and manufacturing followed by the consumer stage.

But the other impacts of food waste – emissions, water loss and costs – are all highest at the consumer stage. Why is this? By the time food gets to the consumer, it has accrued emission, water and cost impacts from across the entire supply chain. In other words, food wasted at the consumer stage wastes more invested materials and resources than in any previous stage.

The process of managing and treating waste that does arise has very little impact in Victoria to emissions, water and cost – the main impacts are embedded in the foods that become waste. Because of this, we shouldn't only focus on reducing waste to landfill, which is very important to recovering valuable resources, but we should try our best to prevent waste happening in the first place. This is especially important at the consumption stage, where food waste has such a high impact.

Food waste impacts across the supply chain

Supply chain stage	Emissions (kt CO2e) 	Water use (ML) 	Cost (\$M) 	Volume (tonnes)
Primary	55	24	218	271,472
Processing	365	125	486	1,140,769
Distribution	98	11	195	53,485
Retail	363	19	635	102,778
Consumption	2085	295	4643	866,561
Waste treatment	196	17	80	-

Food waste volumes



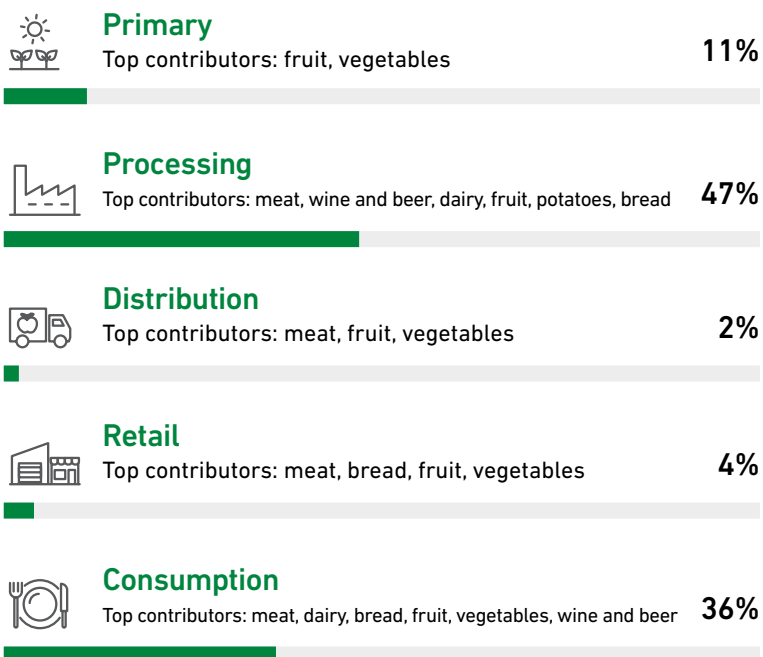
Victoria is the second most populated state in Australia – home to a quarter of Australia’s population. But we also grow and manufacture a lot of food – we produce about a quarter of Australia’s food and process close to a third of all Aussie made food (by value). For these reasons, we also have a big opportunity to contribute to reducing food waste, and gaining the benefits from doing so.

We have a lot of scope to reduce food waste volumes at the processing and consumer stages. Different foods offer different reduction opportunities, due to the varied quantities of different food types typically produced, consumed and wasted in Victoria. The column on the right illustrates this variation in the volume produced, consumed and wasted by food type.

We do need to be careful about viewing food waste as a quantity issue. It might seem logical to target the big food waste generators by volume, but doing so may do little to tackle the real issues associated with food waste – the environmental and cost impacts.

Take dairy as an example – we see masses of food waste at the processing stage, but very little impact on emissions, water and costs. Converting all dairy waste from cheese manufacturing to animal feed would take us 25 per cent closer to our food waste reduction target of 1.2 million tonnes – a huge indent. But we would have done little to tackle the other impacts of food waste.

Proportion of waste volume generated by supply chain stage



Volume impact stats

Each year, food waste in Victoria is responsible for:

2.4m tonnes

of food waste each year

Where is it wasted?

Waste volumes for 12 commonly wasted foods in Victoria (in tonnes per year)

Beef	181,000 t
Milk	230,000 t
Cheese	325,000 t
Bread	186,000 t
Nuts	4,000 t
Apples	43,000 t
Tomatoes	68,000 t
Tomatoes canned	124,000 t
Potatoes fresh	121,000 t
Potato chips	48,000 t
Wine	57,000 t
Beer	131,000 t

Climate change



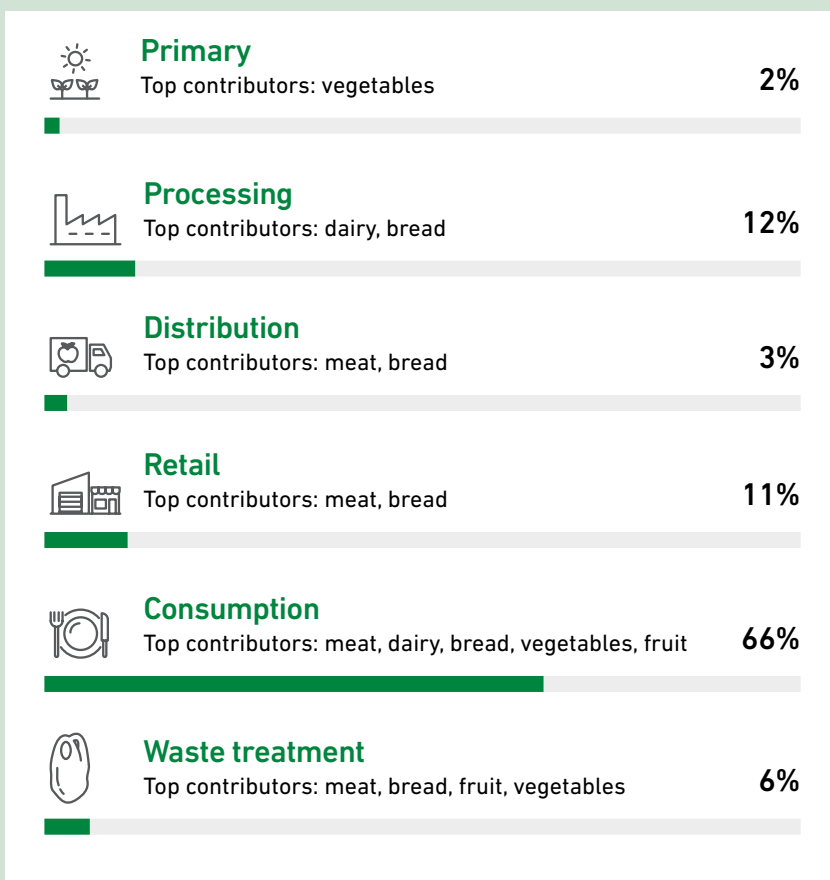
Arguably the most pressing issue of our time, climate change is strongly linked to every part of the food supply chain.

Food waste in landfill contributes to these greenhouse gas emissions, but most of the impact comes from the accumulation of inputs across the supply chain – the energy used to grow, process and distribute food before consumption.

Composting or recovering energy from food waste are great final solutions to maximise the recovery of resources from unavoidable food waste, but to really reduce emissions we should prevent waste from happening in the first place. At the same time, halving food waste from all supply chain stages will not lead to a 50 per cent reduction in emissions, due to the greatest impact coming at the consumption end.

Our best chance to reduce emissions from food waste is preventing food waste from happening in the first place. We can do this best by targeting edible and avoidable food waste at the consumption stage.

Proportion of emissions generated by supply chain stage



Climate impact stats

Each year, food waste in Victoria is responsible for:

3.15m tonnes of CO₂e

2.8% of Victoria's total emissions

15% of Victoria's non-energy emissions

Food waste emits the same CO₂e as one million cars – about one quarter of all registered cars on Victorian roads.

Biggest supply chain impact:

Consumption, particularly disposal of food waste to landfill, due to embedded emissions.

Water



Victoria is Australia's food bowl and agriculture is responsible for the majority of fresh water consumption in food production. Making food uses over 60 per cent of all Victorian water each year, three times more than the water used by all Victorian households. Food waste is responsible for over 30 billion litres of water loss each year.

As we face a future with less water, we need to work smarter with this precious resource.

Much like climate change, water loss is biggest at the consumer stage due to the losses accumulated over the food lifecycle.

Producing food uses around 60 per cent of all water used in Australia.

Water impact stats

Each year, food waste in Victoria is responsible for:

30.9 GL
of water loss

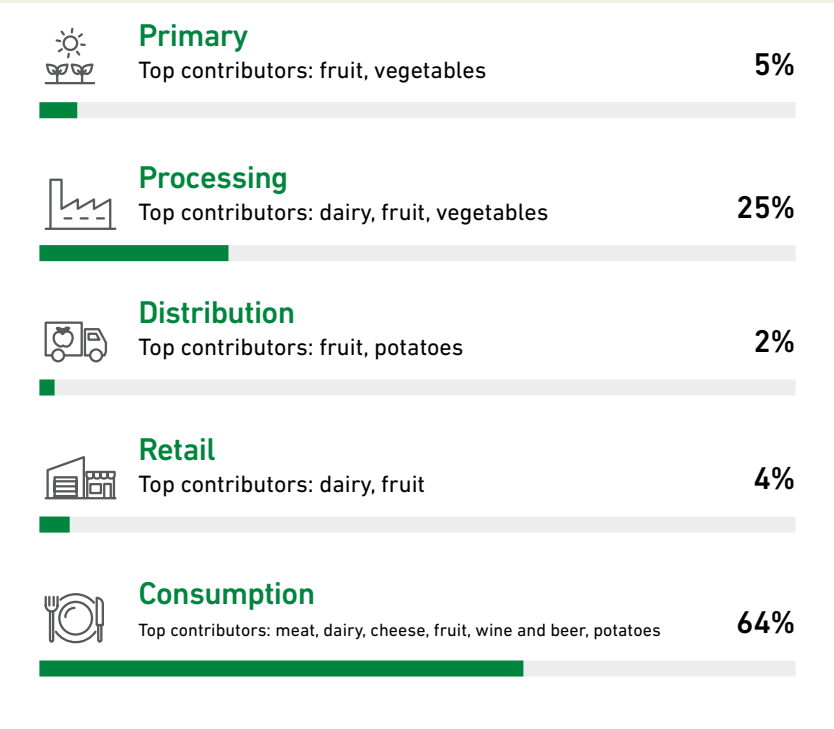
This is equivalent to 8 per cent of all residential water use in Victoria.

Thirstiest foods – how much water gets wasted?

Water loss along the processing and consumption phases of the supply chain.

Cheese	6900 ML
Dairy	10,700ML
Fruit	4900ML
Wine and beer	1100ML

Proportion of water loss by supply chain stage



Cost



Food waste costs Victoria about \$6.3 billion a year – that’s about \$985 per person. Three-quarters of this cost is borne by households and food service businesses since they have more edible/avoidable food waste compared to relatively lower value pre-consumer waste.

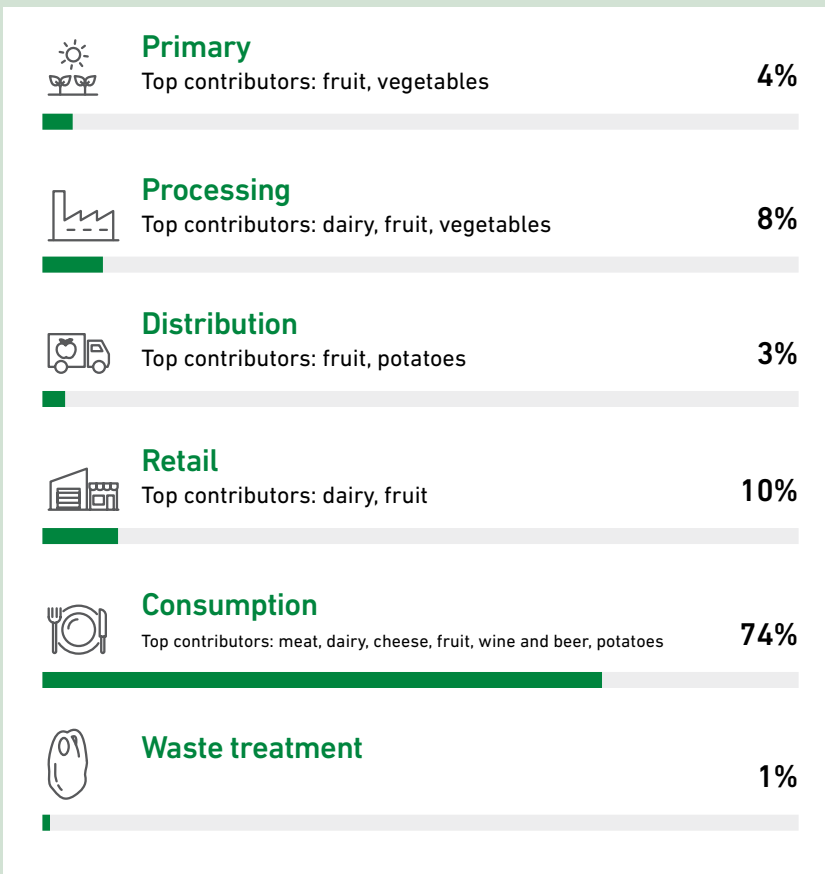
Food costs were calculated based on the value of lost food and the cost to dispose of waste to landfill or recover for composting and energy. It does not include other costs such as disposing of food to sewer or managing, collecting and transporting waste. The full economic cost of food waste to Victoria may actually be much higher.

The waste from just three foods – meat, bread and fruit – costs Victorian consumers \$3.3 billion a year. That’s \$532 per person. While waste from wine and beer costs our bars, pubs and food venues more than \$300 million a year.

The biggest financial losses are at the consumer stage. Much like emissions and water, the cost impact of waste increases the further along the supply chain it occurs.

Our best chance to save Victorians money along the path to half is by preventing food waste in households, food retailers and hospitality venues and by reducing waste from meat, bread, fruit, potatoes, wine and beer.

Proportion of cost impacts by supply chain stage



Cost impact stats

Each year, food waste costs Victorians:

\$6.3 bn

of water loss in estimated product value and disposal costs per year

\$985

per person

Biggest supply chain impact:

Consumption due to the accumulation of impacts across the supply chain

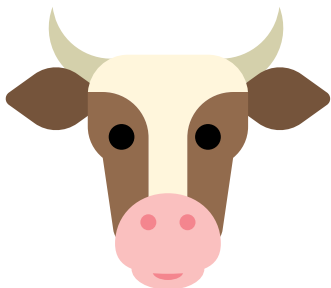
Where does my money go?

Average economic impact in dollars per tonne of waste across the supply chain

Beef	\$2958
Milk	\$1075
Cheese	\$678
Bread	\$4279
Apples	\$2760
Tomatoes	\$931
Tomatoes canned	\$1363
Potatoes fresh	\$1819
Potato chips	\$780
Wine	\$1624

The top six to fix

Based on the foods with the highest waste volume, climate, water and cost impacts, six foods emerge as the first contenders to target with waste reduction solutions. Targeting these six foods could reduce food waste by up to 1.5 million tonnes.



Meat (543,000 tonnes)

Meat is our largest contributor to climate change when it is wasted. It's also the second most expensive food we waste, so reducing it will put more money in our pockets.

The large volumes of meat waste at processing is mainly 'blood and guts' and is not food we would typically eat. Meat wasted in hospitality businesses and households is higher value and has a bigger impact on emissions, water and cost, especially when we throw out uneaten food or leftovers.

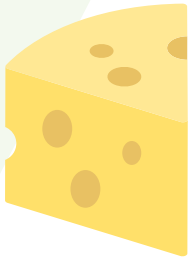


Milk (230,000 tonnes)

Wasted milk is one of the highest contributors to climate, water and economic impacts. More than 90 per cent of milk waste occurs in hospitality businesses, institutions and households.

Every litre of milk waste prevented at these locations saves 2.4kg of carbon emissions and \$1.40.





Cheese (331,000 tonnes)

Victorians love cheese. We make 200,000 tonnes every year and eat about half of that. For every kilo of cheese eaten, we produce over a kilo of waste. Reducing cheese waste is the fourth highest solution to cutting emissions from food waste and the second best water saving solution.

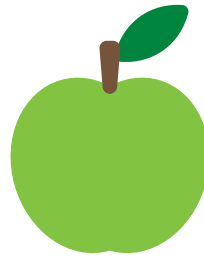
Much of this waste comes from processing soft cheeses like mozzarella and ricotta, but we also waste lots in households and hospitality.



Bread (186,000 tonnes)

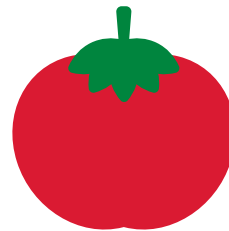
Hospitality businesses, grocery stores and households throw away large quantities of bread. For every loaf we eat, half a loaf is thrown away.

Bread waste is the third highest contributor to climate change, right after dairy and meat. And it comes at a high price – bread waste costs Victoria almost \$800 million each year.



Apples (43,000 tonnes)

For every apple eaten, we waste half an apple on average. Apples (and fruits in general) are one of the biggest opportunities to cut food waste. Reducing fruit waste would save money and could improve food security if we rescue these foods and give to communities in need.



Tomatoes (197,000 tonnes)

Every kilo of fresh or canned tomatoes eaten creates almost 750 grams of waste. Tomatoes are our primary focus for vegetables, although potatoes are a close second. Rescuing and redistributing vegetables before they become waste at farms and along the supply chain could improve food security in Victoria.



Stage of the supply chain where this food has significant impact when wasted.



Primary



Processing



Distribution



Retail



Consumption

Food waste solutions

Across the globe, we are seeing lots of new and inventive solutions to food waste. From creating new products from waste to helping growers, manufacturers and consumers change attitudes and behaviours, there are many ways to approach food waste.

The top six to fix tells us which foods to target for the greatest benefits to emissions, water and the economy. Now we look at the types of food waste solutions that can help us reduce food waste and its impacts across the supply chain in Victoria.

Understanding the data

We identified 25 solutions that could help us on the path to half. While some solutions tackle specific food groups, most apply across different food groups and different parts of the supply chain. Solutions are grouped under four themes.

Each food waste solution was assessed to see:

- ▶ the amount of food waste in-scope for that solution
- ▶ the diversion potential – how much food waste we could prevent from happening
- ▶ climate savings (reduction in greenhouse gas emissions)
- ▶ water savings
- ▶ cost savings (value of lost food and disposal costs)

Climate, water and cost savings are presented as a benefit per tonne of food waste avoided.

Figures were calculated using food waste research, life cycle analysis, projects and expert advice. Every effort was made to make a realistic (and usually cautious) estimate of benefits. However, the diversion potential of solutions could be higher or lower than the figures listed here and solutions may need to be re-assessed to understand how they would work in Victoria.

Some solutions also tackle the same sources of food waste as other solutions. For example, standardised date labelling and better information for longer shelf life of products could both potentially reduce food waste by 4.8 per cent from the same 597,000 tonnes of household waste. By targeting the same waste sources, the overall benefit may be less than the sum of both solutions.

Our 25 food waste solutions are grouped under four themes:

Products, processing and packaging

Turn processing waste into other products, get more products to consumers and help consumers enjoy those products for longer.

Efficient business operations and supply chain

Process foods more efficiently and keep food fresh as it moves from farm to fork.

Education and behaviour change

Help households and businesses take steps to reduce food waste.

Food rescue, recovery and donation

Redistribute surplus food and sell it at a discount or give it to people who are doing it tough.

	Waste reduction potential	Savings per tonne of waste reduced		
		Climate	Water	Costs

Products, processing and food waste solutions

Animal feed from insects	■	●	●	●
Processed food waste to chicken feed	■	●	●	●
Dairy waste to animal feed	■	●	●	●
Processing technology to improve shelf life	■	◆	■	◆
Standardised date labelling	◆	■	■	■
Better information for longer shelf life	◆	■	■	■
Fibre products from food waste	◆	●	◆	●
New food products from processing waste	●	●	●	●
Nutrient extraction from processing waste	●	●	●	●
Packaging size and design adjustments	●	■	■	■
Relax produce specifications at retail	●	●	●	◆

Efficient business operations and supply chain solutions

Waste tracking and analytics	■	◆	■	■
Improved cold chain management	■	◆	◆	■
Whole crop purchase contracts	◆	●	●	●
Centralised and 'dark' commercial kitchens	◆	◆	■	■
Manufacturing line optimisation	●	●	●	●

Education and behaviour change solutions

Household behaviour change programs	■	■	■	■
Hospitality and food service solutions	◆	■	■	■
Waste audits at hospitality and institutions	◆	■	■	■

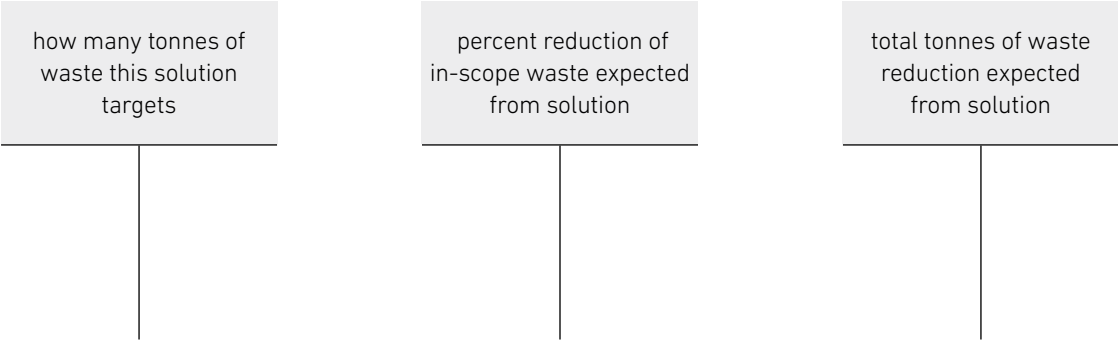
Food rescue, recovery and redistribution solutions

Business-to-consumer platforms	■	◆	■	■
Increase food rescue across supply chain	■	◆	■	◆
Secondary resellers	◆	◆	●	◆
Legislating food rescue at retail	◆	■	●	■
Sustainable catering guidelines and procurement	●	■	■	■
Online platform for surplus products	●	◆	●	◆

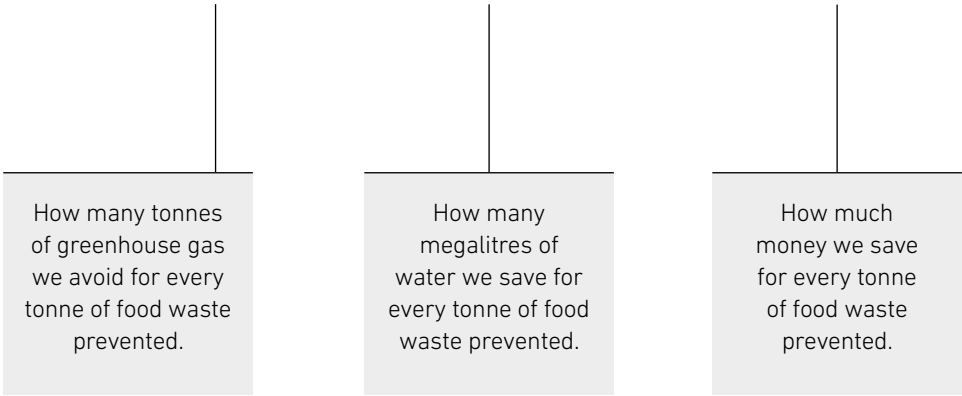
■ High impact ◆ Medium impact ● Low impact

Understanding the Solutions

Under each solution description in the following pages, we present the data like this:



Amount of applicable food waste	Estimated reduction using solution		
“10,000 tonnes”	→		
For every tonne of food waste reduced, we could save:	“3 Tonnes” carbon dioxide (CO2-e)	“10ML” Million litres (ML)	“\$3000” Dollars (\$)
	Climate	Water	Cost



Products, processing and packaging solutions

These solutions address food waste at the processing stage, which is where we currently see the largest volumes of food waste.

Food waste at the primary production and processing stage is typically uncontaminated, in high volumes and somewhat centralised to either the area where it's grown or processed, giving lots of scope for reducing wastage. However, some high-volume solutions, like converting food waste to animal feed, have only a small impact on climate, water and costs, but provide a big impact on reducing waste to landfill.

Extending the shelf life of foods during processing has a big knock-on effect downstream at the consumer stage, as does increasing the shelf life of products and helping consumers interpret shelf life information. Waste reduction in households holds the biggest emissions reduction potential because of the impacts accumulated as food travels along the supply chain.

High impact solutions

Best for reducing waste volumes

Processed food waste to chicken feed	163,653 t	 <p>Waste volumes</p>
Animal feed from insects	163,653 t	
Dairy waste to animal feed	162,800 t	
Processing technology to improve shelf life	125,862 t	

Best for climate*

Standardised date labels	3.56 t CO2e	 <p>Climate change</p>
Better information for longer shelf life	3.56 t CO2e	
Packaging size and design adjustments	3.56 t CO2e	
Processing technology to improve shelf life	2.49 t CO2e	

Best for saving water*

Processing technology to improve shelf life	46,000 L	 <p>Water loss</p>
Standardised date labels	31,000 L	
Better information for longer shelf life	31,000 L	
Packaging size and design adjustments	31,000 L	

Best for saving money*

Packaging size and design adjustments	\$3958	 <p>Economic costs</p>
Better information for longer shelf life	\$3957	
Standardised date labels	\$3957	

*Benefit per tonne of food waste avoided.

Dairy waste to animal feed

Liquid whey produced in the dairy industry can be used to make animal feed. In large facilities, whey is commonly spray-dried and converted to food-grade whey protein powder. Many smaller and medium cheese producers do not have access to this technology. New technologies like roller-drying or a centralised processing facility could help manufacturers convert their liquid waste into animal feed at a lower cost, saving them money by eliminating waste to sewer costs. Dairies could also directly ship liquid whey to farms for animal feed, although this may be expensive since many factories are in Melbourne and not in agricultural zones.

Amount of applicable food waste	Estimated reduction using solution		
296,000 tonnes dairy processing waste	→	50% (148,000 tonnes)	
For every tonne of food waste reduced, we could save:	0.01 carbon dioxide (CO ₂ -e)	0L Million litres (ML)	\$23 Dollars (\$)
	Climate	Water	Cost

Animal feed from insects

Food waste can be diverted to feed insects and make animal feed from dried insect larvae. Food waste treatment using insects is currently being explored by Australian start-ups and is already used in China, Indonesia and Europe to treat food waste from businesses and households.

This could create a cost competitive and resilient animal feed supply chain for domestic industry and a diverse and profitable market for recovered organics. Consideration must be made for biosecurity and regulation in Victoria.

Amount of applicable food waste	Estimated reduction using solution		
655,000 tonnes farm, processing, distribution and retail waste (excluding wine and milk)	→	25% (163,653 tonnes)	
For every tonne of food waste reduced, we could save:	0.17 carbon dioxide (CO ₂ -e)	0L Million litres (ML)	\$48 Dollars (\$)
	Climate	Water	Cost

Business food waste to chicken feed

Food waste can be converted into chicken feed, replacing the use of grain and improving biodiversity by reducing land-use pressure from growing crops to feed animals. This solution requires research and buy-in from the chicken industry to ensure sufficient volume, supply, price, consistency, quality of feed and also chicken meat, and to maintain food safety. Animal feed policy and regulation may be required. The technology behind this process also creates a commercial-grade liquid fertiliser, adding additional value to the solution.

Amount of applicable food waste	Estimated reduction using solution		
655,000 tonnes farm, processing, distribution and retail waste (excluding wine and milk)	→ 25% (163,653 tonnes)		
For every tonne of food waste reduced, we could save:	0.26 T carbon dioxide (CO ₂ -e)	100L Million litres (ML)	\$63 Dollars (\$)
	Climate	Water	Cost

Processing technology to improve shelf life

Improving the shelf life of products like bread and milk would see big food waste savings at the retail and consumption stages. Standardising the implementation of microfiltration processes for fresh milk products can increase shelf life by 40 per cent, from 15 to 21 days. Once we see how this works for milk, it could be extended to other foods, including the six to fix. The main barrier is the potential cost to implement a new technology on a large scale.

Amount of applicable food waste	Estimated reduction using solution		
140,000 tonnes milk lost in retail, household, hospitality and institution waste	→ 90% (125,862 tonnes)		
For every tonne of food waste reduced, we could save:	2.49 T carbon dioxide (CO ₂ -e)	46,000L Million litres (ML)	\$1421 Dollars (\$)
	Climate	Water	Cost

Standardised date labelling

Household food waste could be reduced by 4.8 per cent by streamlining product labelling to only keep a single, clear, 'use by' date. Removing 'best before' and other date information (e.g. made-on-date and sell-by-date) would help consumers understand product safety and quality. Given Australia's regulatory framework, this solution is likely to need cross-sector collaboration at a national level, and a consumer awareness campaign to ensure updated messaging is clear.

Amount of applicable food waste	Estimated reduction using solution		
597,000 tonnes household waste	→	4.8% (28,671 tonnes)	
For every tonne of food waste reduced, we could save:	3.56 T carbon dioxide (CO ₂ -e)	31,000L Million litres (ML)	\$3957 Dollars (\$)
	Climate	Water	Cost

Better information for longer shelf life of products

Giving consumers better information on how to use and store products will reduce wastage by avoiding spoiling. For example, many consumers believe that bread stays fresher in the fridge when it actually makes bread go stale six times faster. Bread can last up to two weeks longer if kept in its original packaging outside the fridge, and this is similar for many other food products. Clear and simple on-pack information can help reduce consumer food waste, even for pre-packaged fresh produce.

Amount of applicable food waste	Estimated reduction using solution		
597,000 tonnes household waste	→	4.8% (28,671 tonnes)	
For every tonne of food waste reduced, we could save:	3.56 T carbon dioxide (CO ₂ -e)	31,000L Million litres (ML)	\$3957 Dollars (\$)
	Climate	Water	Cost

Nutrient extraction from wine processing wastes

Processing waste often contains nutrients that can be extracted and used in other ways, thus creating more valuable outlets for low-value byproducts and waste. This is already happening in the wine industry overseas. Wineries extract polyphenol (micronutrients from some plant-based foods) from the solid remains of grapes after pressing and antioxidants from the dead yeast cells leftover from fermentation.

The technology can be slow to develop and the environmental trade-off is unclear. With a large potential to reduce waste volumes, the wine industry could work with research institutions to commercialise nutrient extraction options that are carbon positive or carbon neutral. Other processing wastes could be suitable for this solution, including fruit and vegetable processing, and the application of this solution across a broader range of processing wastes should be explored further.

Amount of applicable food waste	Estimated reduction using solution		
34,600 tonnes wine processing waste	→	25% (8646 tonnes)	
For every tonne of food waste reduced, we could save:	-0.14 T carbon dioxide (CO2-e)	-5,500L Million litres (ML)	-\$1661 Dollars (\$)
	Climate	Water	Cost

Fibre products from fruit waste

Fruit fibre can be used to make non-food products, such as textiles. This is already happening in Australia and overseas and could help avoid the negative pesticide impacts from cotton fibre production. Great examples of this solution include pineapple leather and orange silk.

Challenges include normalising use of this new fibre over the long term and ensuring a consistent and high-quality supply for production. R&D and grants could help businesses and start-ups wanting to develop innovative non-food products from waste.

Amount of applicable food waste	Estimated reduction using solution		
94,800 tonnes apple and orange processing waste	→	25% (23,705 tonnes)	
For every tonne of food waste reduced, we could save:	0 T carbon dioxide (CO2-e)	14,000L Million litres (ML)	\$494 Dollars (\$)
	Climate	Water	Cost

New food products from processing waste

New food products can be manufactured from common waste products. Current examples include making beer from bread waste and producing apple flour from off-specification produce. These solutions can generate new revenue streams while saving money from waste costs. Some examples already exist and could be increased in scale and applied to a wider variety of Victoria's food types, such as new products from tomato and potato waste or even from spent grain used to make beer. The waste volumes and types assessed for this solution are conservative – a much greater potential is possible in Victoria, for example, spent grain produces around 60,000 tonnes of waste in Victoria each year and this could be transformed into "beer flour".

Amount of applicable food waste	Estimated reduction using solution		
39,400 tonnes bread waste from retail and apple waste from farms and processing	→	25% (9838 tonnes)	
For every tonne of food waste reduced, we could save:	0.06 T carbon dioxide (CO ₂ -e)	0L Million litres (ML)	\$30 Dollars (\$)
	Climate	Water	Cost

Packaging size and design adjustments

Packaging design can be tweaked to help consumers finish foods before they go off. For example, half loaves of bread, more widespread use of vacuum-sealed packs for meat products, resealable packaging for cheese or frozen goods, half bottles of wine and packaging that makes it easy to extract spreads, yoghurts and sauces. This could also benefit consumers by improving food safety, although there may be an environmental trade-off from increasing the packaging to product ratio.

Amount of applicable food waste	Estimated reduction using solution		
613,000 tonnes household waste	→	0.8% (4904 tonnes)	
For every tonne of food waste reduced, we could save:	3.56 T carbon dioxide (CO ₂ -e)	31,000L Million litres (ML)	\$3958 Dollars (\$)
	Climate	Water	Cost

Relax product specifications at retail

Many fruits and veggies are rejected by retailers for being cosmetically imperfect or 'ugly'. Relaxing the rules around what retailers will accept would allow farmers to sell more of their produce and reduce on-farm food waste. Offering these foods at a discount could improve access to fresh food for lower income families. For this to work, consumers need to be encouraged to accept produce that does not meet retail standards, but we've already seen some successful Australian education campaigns and promotions by the major supermarkets for 'odd' looking produce.

Amount of applicable food waste	Estimated reduction using solution		
236,000 tonnes farm waste	→	1% (2363 tonnes)	
For every tonne of food waste reduced, we could save:	0.29 T carbon dioxide (CO ₂ -e)	9000L Million litres (ML)	\$1041 Dollars (\$)
	Climate	Water	Cost

In 2019, Sustainability Victoria, RMIT and Woolworths joined up with the Fight Food Waste Cooperative Research Centre (CRC) to explore the role of packaging in reducing food waste. This \$300,000 collaborative project aims to identify opportunities for industry to help eliminate food waste through updated packaging formats and messaging.



CASE STUDY:

A new cheese made with leftovers from the winemaking process sparks conversations on food waste and sustainability

With his Italian winemaking heritage, Mario Marson is no stranger to the circular economy.

“In Europe it’s very common for winemakers to send the grape skins to be distilled into grappa, then returned for compost as part of the food cycle,” explained Mario, the owner and chief winemaker at his family-run business, Vinea Marson in Central Victoria.

Taking inspiration from Italy, Mario found a local cheesemaker, Giorgio Linguanti of That’s Amore Cheese, to produce a ‘drunken cheese’. The resulting award-winning Drunken Buffalo is coated in edible Nebbiolo grape skins, seeds and lees – the byproduct of fermenting wine.

“It feels good to use up these byproducts and see people enjoying eating the Drunken Buffalo. People think grape skin, seeds and lees are not edible products, and they’re quite surprised by the small changes in flavour they give to the cheese.”

At Vinea Marson, little goes to waste.

“From one tonne of grapes, we extract 700 kilos of wine, leaving 100 kilos of stems and 200 kilos of skins. We use 100 kilos of stems for cattle and sheep feed. The skins are used for cheese or are sent away to be distilled into grappa, with all the leftovers composted.”

“The great thing about the cheese is that it’s given us an end product to share with our customers at the cellar door,” explained Madeleine Marson, who works alongside her father in the family business. “We use it to talk about our family story, our traditions and that leads naturally into a discussion about sustainability.”

Efficient business operations and supply chain solutions

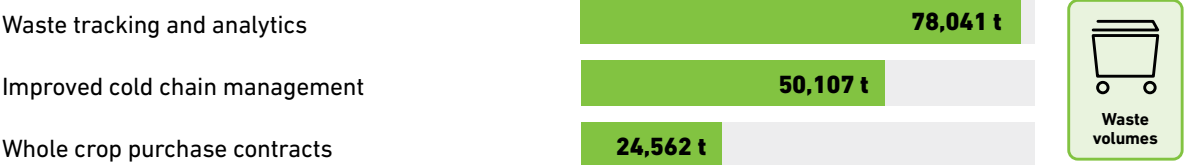
These solutions look at how we can reduce food waste as food moves from farm to fork.

The way we process, manage, ship and store food all affect how much food ends up on our tables. Processing foods more efficiently and keeping food fresh on its travels will both help reduce food waste.

Solutions implemented early in the supply chain can reduce waste downstream. For example, good temperature control keeps food fresh as it travels along the supply chain, which helps to reduce food waste at distribution and retail, but also for consumers in households and hospitality businesses.

High impact solutions

Best for reducing waste volumes



Best for climate*



Best for saving water*



Best for saving money*



*Benefit per tonne of food waste avoided.

Waste tracking and analytics

Waste tracking systems track the volume and cost of waste within businesses to understand the reasons for food loss and encourage operational and behavioural changes in the business.

Simulations show a 25 per cent reduction in food waste, although some companies have reduced food waste by as much as 50 per cent. Barriers include implementation costs, the initial learning curve and the ongoing behaviour change required to successfully reduce food waste through this solution. This solution is most suited to avoidable food waste.

Amount of applicable food waste	Estimated reduction using solution		
312,000 tonnes hospitality and institution waste (all foods)	→ 25% (78,041 tonnes)		
For every tonne of food waste reduced, we could save:	2.73 T carbon dioxide (CO ₂ -e)	28,000L Million litres (ML)	\$3217 Dollars (\$)
	Climate	Water	Cost

Improved cold chain management

The cold chain refers to the logistic systems used to distribute chilled or frozen food from production to consumption. For many products, chilling or freezing extends product shelf life (e.g. strawberries) and for others it ensures food safety (e.g. dairy products, meat). Most fruits, vegetables, meat and dairy products are transported through the cold chain.

Good temperature control keeps food fresh as it travels along the supply chain, which helps to reduce food waste not just at distribution and retail, but also for consumers. Best practice standards in cold chain management helping to reduce food waste include temperature trackers, improving traceability throughout the cold chain and raising equipment and insulation standards.

Amount of applicable food waste	Estimated reduction using solution		
173,000 tonnes distribution and retail waste for meat, dairy, fruit and vegetables	→ 50% & 25% (50,107 tonnes) Distribution Retail		
For every tonne of food waste reduced, we could save:	1.02 T carbon dioxide (CO ₂ -e)	11,000L Million litres (ML)	\$3583 Dollars (\$)
	Climate	Water	Cost

Whole crop purchase contracts

Under this contractual arrangement, processors, wholesalers or retailers buy entire crops and manage supplying different product grades to different markets. This would increase the food output of our farms, although there could be some resistance from processors, who would need to find new ways to use and process produce that does not meet retail standards. Existing contractual arrangements may also need to be renegotiated.

Amount of applicable food waste	Estimated reduction using solution		
123,000 tonnes on-farm waste (fruits and vegetables)	→	20% (24,562 tonnes)	
For every tonne of food waste reduced, we could save:	0.29 T carbon dioxide (CO ₂ -e)	6000L Million litres (ML)	\$712 Dollars (\$)
	Climate	Water	Cost

Centralised and 'dark' commercial kitchens

Dark kitchens are virtual restaurants supplying food through web portals or mobile apps. Centralising a kitchen can help reduce waste through economies of scale by creating mini circular economies within the kitchen. Unneeded foods from one area, such as a broccoli stalks, may be used in another area to create a new meal. Or perhaps excess meals produced could be easily redistributed to charities or sold at a discount through online platforms.

Dark kitchens are already used in Melbourne for popular food delivery services and could be targeted to help reduce food waste in the hospitality sector, at scale.

Amount of applicable food waste	Estimated reduction using solution		
153,000 tonnes hospitality waste	→	10.3% (15,715 tonnes)	
For every tonne of food waste reduced, we could save:	2.48 T carbon dioxide (CO ₂ -e)	22,000L Million litres (ML)	\$3621 Dollars (\$)
	Climate	Water	Cost

Manufacturing line optimisation and materials efficiency assessments

Manufacturers can look for opportunities to reduce food waste from their operations, for example, by improving fruit and vegetable sorting infrastructure. Consultants could provide in-person support to assess opportunities to optimise food materials and reduce food waste. Businesses could then use the assessment results to understand the costs and benefits of various solutions. Dairy processing could benefit from optimising the manufacturing line, and fruit and vegetable processors could benefit from better sorting technology.

Amount of applicable food waste	Estimated reduction using solution		
<p style="text-align: center;">443,000 tonnes manufacturing waste (excluding whey, hull and shells, wine lees and marc)</p>	<p>→ 1.9% (8418 tonnes)</p>		
<p>For every tonne of food waste reduced, we could save:</p>	<p style="text-align: center;">0.88 T carbon dioxide (CO2-e)</p>	<p style="text-align: center;">5500L Million litres (ML)</p>	<p style="text-align: center;">\$887 Dollars (\$)</p>
	Climate	Water	Cost

Launched in 2020, the Victorian Government’s \$17 million Circular Economy Business Innovation Centre (cebic.vic.gov.au) and Business Support Fund are now supporting businesses and supply chains to use resources more efficiently and reduce waste.



CASE STUDY:

No vegetables left behind

Photo: Breeana Dunbar

Nelle and Scott Baird work directly with farmers to sell produce that is rejected for being too big, too small, or quite simply too ugly.

“It came to our attention that for some farmers, 25 per cent of food never even left their farms,” explained Nelle, co-owner of the Real Food Grocer.

“We realised that we could help change this by dropping our aesthetic standards. Our apples might have sunspots and our cucumbers might be oddly shaped, but they taste just as good, if not better due to the freshness, they save us and our customers money, and are just as nutritious.”

Nelle and Scott sell at least 150 tonnes of farmer-grade produce per year, saving it from being wasted or heading to landfill. This is good for farmers who can sell their imperfect produce for a fair price. Chefs are even embracing odd-looking produce for its unique aesthetic and for their customers seeking fresh, local, seasonal and sustainable meals.

“Your body doesn’t know if the carrot was bent,” explained Scott. “The farmer puts the same amount of effort into it, so it shouldn’t be treated as a waste product.”

Just a simple switch to ‘ugly’ apples could substantially reduce greenhouse gases. And the Real Food team buy exactly what they need direct from suppliers so there’s no wastage in their warehouse.

“The small amount of waste that we do accumulate through our packing process – such as non-edible food scraps and leftover liquid from boxes of broccoli – is composted onsite.”

“We’ve seen a considerable shift in consumer opinion over the past few years – more demand for ugly produce, and less of a need to educate our customers on what that means,” explained Nelle. “The growth of our business just goes to show that consumers are passionate about this too.”

Education and behaviour change solutions

Behaviour change programs typically target businesses and households to make them more aware of food waste and how they can reduce it.

These programs usually need a long-term and sustained investment but can have a huge impact on reducing food waste and its impacts, since it's the last stage of the supply chain, where we see the biggest losses in emissions, water and costs.

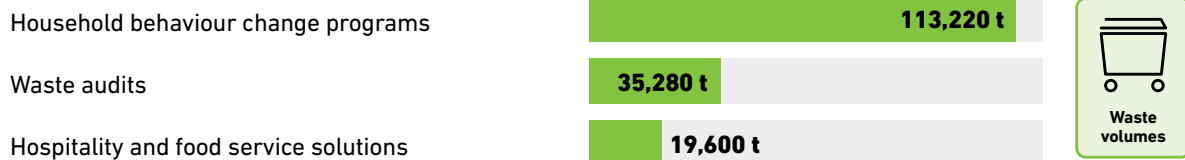
Businesses can use waste audits and other business efficiency solutions to see where to make operational and behavioural changes.

Simple changes can result in big savings for households and food service businesses due the high amounts of edible/avoidable food waste.

These solutions build on existing successful campaigns on avoidance and reuse, such as Love Food Hate Waste; a Sustainability Victoria campaign to raise awareness of avoidable food waste from Victorian households and businesses which has been delivered since 2014 and recently expanded from households into businesses and schools.

High impact solutions

Best for reducing waste volumes



Best for climate*



Best for saving water*



Best for saving money*



*Benefit per tonne of food waste avoided.

Household education behaviour change programs

Educating households on food waste topics like food storage and meal planning can save consumers money on groceries and reduce food waste to landfill. It can be difficult to get people to permanently adopt new ways of doing things, so programs need to be sustained over the long term. One of the most successful global programs reduced household food waste by 18 per cent (WRAP UK) but over a nine-year period. This success was driven by a dedicated team and significant time and financial investment, but the impacts on climate, water and costs were well worth it.

Amount of applicable food waste	Estimated reduction using solution		
629,000 tonnes household food waste (all foods)	→ 18% (113,220 tonnes)		
For every tonne of food waste reduced, we could save:	3.56 T carbon dioxide (CO ₂ -e)	31,000L Million litres (ML)	\$3958 Dollars (\$)
	Climate	Water	Cost

Hospitality and food service education and behaviour change programs

Hospitality and food service solutions include menu planning at institutions and hospitality venues, using smaller plates at self-service, providing more portion choices, tray-less dining at buffets and cafeterias, and promoting the use of 'doggy bags' to take home unfinished meals.

These solutions could reduce costs for food service venues and save money for consumers taking home leftover meals. While each individual solution has shown different success rates in practice, offering meals in multiple sizes is one of the most impactful actions a hospitality business can take.

Challenges include uncertainty from business owners on safety or legislation on providing 'doggy bags', time to implement solutions in a busy food service environment, and negative perceptions of smaller plate sizes from consumers.

Business programs like Love Food Hate Waste Business give online and in-person support for food service businesses to help them identify and deliver meaningful waste reduction solutions that work for them. Combined with waste audits, these solutions can have a big impact. Per tonne benefits below are based on offering meals in multiple sizes.

Amount of applicable food waste	Estimated reduction using solution		
Up to 392,000 tonnes hospitality venues and institution waste	→ 5% (19,600 tonnes)		
For every tonne of food waste reduced, we could save:	3.20 T carbon dioxide (CO ₂ -e)	29,000L Million litres (ML)	\$3659 Dollars (\$)
	Climate	Water	Cost

Waste audits at hospitality and institutions

Businesses can reduce food waste and costs by auditing their food waste, then implementing waste reduction techniques and waste reduction plans and targets. Some businesses have significantly reduced food waste by adopting this solution – much higher than the potential reduction listed here. In-person support is often required to help businesses to conduct audits and then implement solutions and review progress over time, however, digital tools could help provide greater access to audits for Victoria’s 21,680 hospitality businesses. Additional cost savings are likely for businesses when considering reduced staff time to purchase, cook and manage wasted food – Love Food Hate Waste estimates savings of around \$7/kg when considering the broader economic opportunity.

Amount of applicable food waste	Estimated reduction using solution		
392,000 tonnes hospitality and institution waste	→	9% (35,280 tonnes)	
For every tonne of food waste reduced, we could save:	3.30 T carbon dioxide (CO2-e)	34,000L Million litres (ML)	\$3210 Dollars (\$)
	Climate	Water	Cost

Supporting Victorians to reduce waste is a key commitment in the \$300 million Recycling Victoria program. By 2030, this policy aims to reduce waste by 15% per capita in Victoria. Behaviour change programs such as Love Food Hate Waste will be key to ensuring all Victorians are supported to reduce waste, in their households and their businesses



CASE STUDY:

Avoiding food waste puts money back in the pockets of businesses

Across Victoria, cafes, restaurants, hotels, pubs, bars and takeaway venues generate around 180,000 tonnes of avoidable food waste each year, half of which could potentially be avoided through behaviour change programs. Reducing avoidable food waste by just 5 per cent would save these businesses \$16.5 million each year, not to mention the savings in emissions and water.

For Giacomo Strappa, Manager at Fonda Hawthorn, food waste was an inevitable, and mostly unnoticed part of running a restaurant. After Fonda Hawthorn joined the Love Food Hate Waste Business program, they began to make small everyday changes to reduce their food waste.

“Measuring waste is important. For the everyday it can be around \$10 of waste, but over 52 weeks it can add up to thousands of dollars,” said Giacomo.

Giacomo said the audit surprised him by highlighting unexpected sources of waste in his business.

Love Food Hate Waste Business is a free program helping Victorian hospitality businesses prevent food waste, reduce costs and increase profits. Participating businesses typically reduce food waste by 3.7 kilos a day, saving an average of \$13.50. That’s almost \$5,000 in savings over the year.

Businesses get food waste tracking tools, action plans and online support to see where food waste is happening in their business. More than 150 Victorian hospitality businesses have already joined the Love Food Hate Waste Business program.

Food rescue, recovery and redistribution solutions

Several different models operate in this sector. In one of the most established approaches, not-for-profit food rescue organisations take surplus food from businesses and redistribute it – often to charities that support Australians who are doing it tough.

Food rescue can happen all along the supply chain, but the biggest impact comes from food rescued from hospitality businesses, wholesalers, and supermarkets - due to the higher embedded impacts towards the end of the supply chain. Social enterprises, including for-profit business models, also operate in this space and prevent food waste by redistributing food that generates a commercial return for participating businesses.

Food rescue can be run for profit, although it is most commonly run by charities to increase food security and support communities – every kilo of food rescued, recovered and redistributed provides two meals for Australians. Victoria has several food rescue charities such as Food Bank, SecondBite, Ozharvest and Fareshare.

We also have several for-profit businesses including Yume and BringMeHome. Food rescue relies on good connections between businesses and food rescue providers and finding ways to encourage organisations to participate in food rescue schemes. Food rescue solutions should ideally be implemented in tandem to get the most benefits. For example, legislating food rescue has huge climate, water and cost benefits per tonne of food waste avoided, but affects a relatively small volume of food waste (7,775 tonnes a year) – by combining this solution with business-to-consumer platforms, the potential benefit is much greater.

High impact solutions

Best for reducing waste volumes



Best for climate*



Best for saving water*



Best for saving money*



*Benefit per tonne of food waste avoided.

Business-to-consumer platforms

Online platforms can help businesses to sell products that would otherwise be discarded to waste. These platforms sell food at a discounted price, typically at the end of each day, transforming waste into money and reducing disposal costs. They are also good for consumers, who can bag a bargain.

Bring Me Home is a Melbourne-designed app that lets you buy and pick up discounted surplus food from nearby cafes, restaurants, bakeries and supermarkets. Y-Waste is another Australian app that connects people in need directly with shops donating surplus food, cutting out the resources needed to pick up and redistribute this food. Growing these solutions can reduce waste at scale.

In Finland, the ResQ app reduced food waste by 83 per cent in K-Market stores across the country.

Amount of applicable food waste	Estimated reduction using solution		
153,000 tonnes hospitality waste	→	50% (76,659 tonnes)	
For every tonne of food waste reduced, we could save:	2.48 T carbon dioxide (CO2-e)	22,000L Million litres (ML)	\$3621 Dollars (\$)
	Climate	Water	Cost

Increase food rescue, recovery and redistribution across whole supply chain

Both for-profit and not-for-profit models could be increased across the whole supply chain, for example through better labelling and storage instructions for redistribution of food, or systems and technologies to simplify and incentivise food donations. Every tonne of food rescued from waste provides up to 2000 meals.

Increasing food rescue across the supply chain is a challenge that requires collaboration and the federal government is exploring this option through its Food Rescue and Relief Sector Action Plan under the National Food Waste Strategy Roadmap.

Amount of applicable food waste	Estimated reduction using solution		
627,000 tonnes on-farm, at distribution, retail and hospitality and institutions	→	10% (62,687 tonnes)	
For every tonne of food waste reduced, we could save:	2.41 T carbon dioxide (CO2-e)	25,000L Million litres (ML)	\$2642 Dollars (\$)
	Climate	Water	Cost

Secondary resellers

Businesses can purchase processed foods and produce directly from manufacturers and distributors for discounted retail sale to consumers. It could be costly to open and operate stores.

Amount of applicable food waste	Estimated reduction using solution		
335,000 tonnes manufacturing and distribution waste	→ 3.3% (11,049 tonnes)		
For every tonne of food waste reduced, we could save:	1.43 T carbon dioxide (CO2-e)	5,500L Million litres (ML)	\$1586 Dollars (\$)
	Climate	Water	Cost

Legislating food rescue at retail

We could legislate the waste food waste hierarchy, making it unlawful for retailers to destroy edible unused food and mandatory to allow food banks and not-for-profits organisations to distribute excess edible food. France recently delivered new regulations that increased food donations by 28 per cent over two years. These changes helped provide millions of additional meals to those in need and reduced emissions, saved money and had a great social outcome. This solution would support efforts to increase food rescue, recovery and distribution across the whole supply chain.

Amount of applicable food waste	Estimated reduction using solution		
Up to 58,000 tonnes food waste in retail businesses	→ 28% (Up to 16,240 tonnes)		
For every tonne of food waste reduced, we could save:	6.60 T carbon dioxide (CO2-e)	3,000L Million litres (ML)	\$6333 Dollars (\$)
	Climate	Water	Cost

Sustainable hospitality guidelines and procurement

Sustainable catering guidelines could help ensure prevention of food waste when planning meals, receiving and storing food, preparing ingredients and meals and after service. Unused food can be donated, and food waste should be separated as appropriate.

All businesses can develop sustainable catering guidelines to reduce waste within their own operations and develop plans to help rescue and redistribute any food waste that does arise.

Amount of applicable food waste	Estimated reduction using solution		
115,000 tonnes hospitality waste (excluding wine)	→		
	3% (3441 tonnes)		
For every tonne of food waste reduced, we could save:	3.49 T carbon dioxide (CO ₂ -e)	40,000L Million litres (ML)	\$3195 Dollars (\$)
	Climate	Water	Cost

Online platform for surplus resources

Software platforms can be used to connect businesses with surplus resources, that would otherwise be wasted, to potential buyers. This includes waste outputs from food manufacture, unsold produce on farms and other surplus unsold foods. By creating an online platform for these valuable food resources, this solution can reduce waste costs for one business by connecting them to a new valuable home, with the 'buyer' accessing a needed resource often at a cheaper price. ASPIRE is an example of a local online 'matchmaking' platform that supports businesses and local government to exchange surplus resources, including industrial waste products.

This solution has been assessed for a mix of surplus food products and processing waste. As each online platform could target different types of waste, this solution would need to be assessed in more detail for the type of waste targeted and the life cycle stage where it occurs.

Amount of applicable food waste	Estimated reduction using solution		
380,000 tonnes primary, processing and distribution waste (excludes beef, dairy and wine processing waste)	→		
	0.3% (1141 tonnes)		
For every tonne of food waste reduced, we could save:	1.00 T carbon dioxide (CO ₂ -e)	5,000L Million litres (ML)	\$1245 Dollars (\$)
	Climate	Water	Cost



CASE STUDY:

The re-catch of the day

A stocktake at one Victorian supplier showed eight tonnes of Australian salmon portions left over from the Christmas season. Thanks to Yume – a wholesale online platform for quality surplus food – they sold their salmon online within a week.

The lucky buyer got 25 per cent off the price, the supplier got a return on their surplus product and together they saved over 19 tonnes of CO₂e and 200,000 litres of water from going to waste.

Yume's business-to-business platform connects suppliers with buyers to offer a solution for quality food that may be close to best before, mislabeled, discontinued, falling short of cosmetic standards, or otherwise stranded due to demand and supply imbalances.

To date, Yume has sold over 2200 tonnes of surplus food. That's an estimated saving of over 5300 tonnes of CO₂e and 48 million litres of water.

Yume also works with primary producers and leading food manufacturers to re-home surplus food with large food service operators and independent retailers and manufacturers. Monash Health recently started purchasing through Yume to provide menu variety, cut costs and reduce food waste. This is a demonstration of the public sector adopting circular economy principles by utilising sustainable procurement practices to deliver substantial economic, environmental and social benefits.

With a 'prevention first' approach to food waste, Yume's range of services deliver against many of the opportunities in this report. Yume helps businesses not only to prevent waste and save money, but also to make money from surplus food sold through its platform.

Yume won three categories at the 2018 Premier's Sustainability Awards and Yume's founder and CEO, Katy Barfield, was the winner of the 2019 AFR Women of Influence Award for Business & Entrepreneur.

Prioritising food waste solutions

It can be challenging to know which food solutions to prioritise. Ideally, we want solutions with the greatest benefits across all four impact areas – waste volumes, climate, water and costs.

We found that some solutions prevent large volumes of food waste, but with negligible impact on climate, water and costs. Conversely, many ‘smaller’ solutions have high climate, water or cost impacts – especially when calculated as a benefit per tonne of waste reduced – but affect relatively small volumes of waste overall.

Victoria needs a multipronged approach that combines numerous solutions to give us the biggest impact across the board.

Quick wins or long-term investment?

Some solutions can be implemented relatively easily now, and some need a sustained and long-term investment. It may be tempting to go for the low-hanging fruit, but we must also prioritise more challenging solutions that deliver big reductions to waste volumes, emissions, water use and costs.

Household behaviour change campaigns and business-to-consumer platforms both need long-term, ongoing effort to see results, but both have been very successful globally at reducing impacts across all four areas.

The interplay between solutions

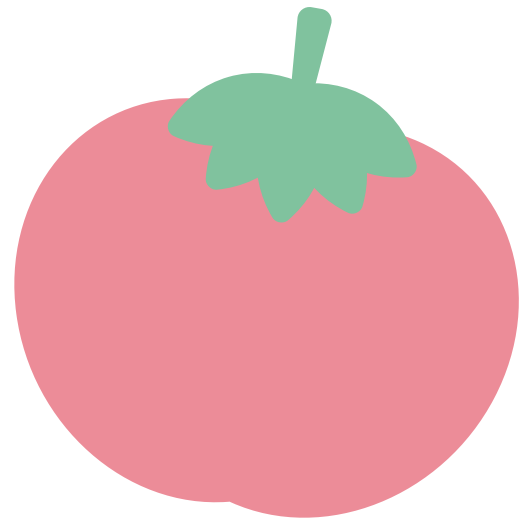
When deciding on solutions, consider that some solutions:

- ▶ may reduce potential benefits from other solutions, for example, a successful food waste behaviour change campaign at retail and hospitality would reduce food waste available for converting to animal feed
- ▶ target the same sources of waste, for example, standardised date labelling and better information for longer shelf life of products target the same amount of available household food waste
- ▶ may conflict with other policies, for example, opportunities involving packaging may reduce food waste at the expense of recyclability targets.

Applying food waste solutions in Victoria

The diversion potential for each solution was based on the best available data from overseas food waste projects and research, and the advice of over 100 Australian experts. Victoria could have higher (or lower) reduction rates than reported here and more research may be needed to understand how solutions would work for us. Research may also be needed into the cost of implementing solutions and the return on investment – as a full cost benefit analysis was not completed for our 25 solutions.

Halfway to half



With only 10 years to meet our food waste target, we need to start implementing food waste solutions now. We can only achieve this by working together with government, industries, businesses and the public.

The eight priorities listed here could get us over halfway to our 2030 target, reducing food waste by over 700,000 tonnes. Some solutions are already being explored or implemented and could be scaled up for a bigger impact. What is important is that we take our first steps, together, on the path to half.

Improve product shelf life

Using milk as an example, a longer shelf life could reduce our total consumer waste by 15 per cent and the impacts of food waste emissions in Victoria by 10 per cent. It would also save households, retailers and hospitality venues about \$178 million each year. This solution could be extended to a range of food products.

Convert food waste into animal feed

Converting high rates of food waste from institutions and hospitality businesses to animal feed could reduce consumer food waste by 20 per cent (163,000 tonnes). It could also free up demand for land used to grow food for animals. New technologies provide different pathways to explore this solution – insects and chicken feed processes are two options.

Increase food rescue, recovery and redistribution

Rescuing 10 per cent of the waste on our farms, and from warehouses, retail and food service venues would save \$165 million dollars, but more importantly, could provide over 188 million meals, which would help Victorians with limited access to fresh and nutritious food. A multipronged approach that includes charities and for-profit businesses is needed.

Tracking waste and analytics

Waste tracking analytics gives us the data to understand food waste and change the way we run our businesses. It could reduce food waste by 78,000 tonnes and provide more food for rescue. Using it across more food sectors could help us to trade and exchange food. This may include both small-scale on-site tracking, or technologies across whole supply chains, such as blockchain and IoT.



Household behaviour change

Household behaviour change is one of the highest-ranking solutions for climate, water and costs. It helps reduce the accumulated impacts of food waste as well as the high impact of food waste disposal to landfill. It takes a long and sustained effort, but it can pay off.

Transform dairy waste into new products

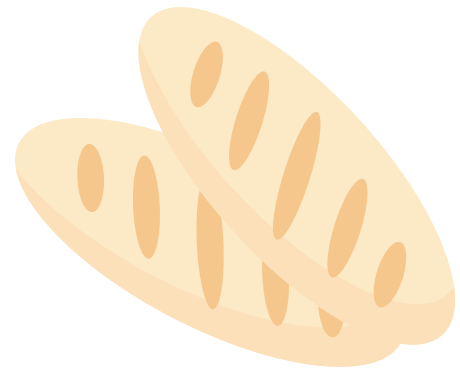
Dairy is one of Victoria's largest production sectors. Processing the whey leftover from making cheese to animal feed could reduce processing waste by 13 per cent (148,000 tonnes), although with relatively little impact on emissions, water and cost. New technologies and centralised processing facilities may be needed to enable this solution to be cost effective.

Food service solutions

Hospitality businesses generate a large amount of avoidable waste, as well as unavoidable waste that could be converted to animal feed. Waste audits can help businesses understand the opportunity to save money by reducing food waste, while practical support will help businesses to put waste reduction solutions into practice.

Improve cold supply chain

Good temperature control keeps food fresh as it travels along the supply chain, reducing food waste and saving distributors, retailers and consumers \$179 million a year.



Supporting solutions

Supporting solutions can also help reduce food waste and encourage greater uptake of the solutions above:

Set up regional waste hubs

With food waste distributed throughout different production regions, it can be hard to get enough waste together to get value from processing and primary waste. The cost of capital, disadvantage of scale and lack of opportunities to develop markets could all be improved by developing regional hubs to develop and implement food waste solutions.

National coordination and collaboration

State-based action should be complemented with a unified national approach. By working together across Australia, we can amplify our efforts. Organisations like the Fight Food Waste Cooperative Research Centre and Stop Food Waste Australia are well positioned to support a national approach to food waste.

Acknowledgments

The Path to Half is based on research commissioned by Sustainability Victoria into food waste and its wider impacts on climate change, water loss and economic costs.

We wanted to understand how international and national food waste solutions could work in Victoria to offset these impacts and help us meet our target of a 50 per cent reduction in food waste by 2030.

One of the key pieces of research for this report was the Food Waste Impacts and Opportunities Analysis (Lifecycles and Edge Environment, July 2020).

We would like to acknowledge and thank the many contributors who generously donated their time, knowledge, research and passion to this important piece of research, particularly global food waste expert Mark Barthel.

We would also like to thank the tireless efforts from our consultants, Edge Environment and Lifecycles, in leading this research.

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