Sustainability Fund / FareShare / Hyder Consulting

# Sustainability Fund Project

## Sustainability Gains Through the Recovery of Unsold or Off-specification food

## Final report


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**Report no:** 1 **Revision** 3 **Date:** 8 October 2008





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# 1 Executive summary

FareShare collects unwanted and surplus food ingredients and prepared meals from many different organisations and provides nutritious emergency food relief to agencies catering to the homeless and hungry of Melbourne.

In 2007–08 FareShare produced 180 000 “value added” meals (weighing 61 tonnes) for people in need, and recovered and distributed a further 383 000 “non-value added” meals (weighing 193 tonnes). In 2008–09 FareShare is on track to produce approximately 500 000 value added meals, and supply a further 500 000 non-value added meals, a total of approximately 400 tonnes of food.

The waste reduction associated with this large scale food recovery has a significant benefit for the environment. Food recovery programs have existed for some time now and are acknowledged for their social and welfare benefits. The environmental benefits of food recovery programs are not as well understood.

The general objective of this study was to review available food Life Cycle Assessment (LCA) data, both Australian and international, to determine the environmental benefits of providing a meal using unsold or off-specification food. In summary, the findings of this analysis of the benefits of food recovery are:

- The estimated benefits of FareShare's food recovery activities in 2008–09 (400 tonnes) is the avoided emissions of 620 tonnes of greenhouse gases ($CO_2$eq) or the annual equivalent of switching off 953 refrigerators for a year, an energy saving equivalent to the annual energy consumption of 519 refrigerators. It also achieves a water saving equivalent to the annual water consumption of 96 households, and a saving in landfill disposal equivalent to the annual generation of 730 households.
- On average, every kilogram of food that FareShare recovers results in a saving of 1.5 kg of greenhouse ($CO_2$eq) emissions, and saves 56 litres of water.
- Assuming that just 10% of the 750 000 tonnes of food thrown out in Victoria each year is off-spec or ‘close to used by date’ food and could be recovered through an organisation such as FareShare, then the potential environmental benefits of its recovery are savings of 113 000 tonnes $CO_2$eq or the annual equivalent of switching off 173 078 refrigerators, and 4.2 GL of water or the annual water consumption of 18 000 households.

The project has also resulted in the development of an MS Excel based *Food Recovery Environmental Benefits Calculator*, for the ongoing determination of the environmental benefits of FareShare’s food recovery and distribution activity. The Calculator incorporates the findings of the review and analysis of food LCA data, and allows the calculation of the impacts of meals across 40 different ingredients.

The quantitative outcomes of this life cycle based analysis of the environmental benefits of food recovery will be used to contribute to the establishment of industry partnerships, including promotion of the findings and outcomes of the report to industry partners to secure additional food donors and corporate supporters.

It is anticipated that this will assist in increasing levels of recovery of food, and subsequently increase the environmental gains achieved through recovery of food. A key outcome of this will be to not simply decrease the environmental burden of food production in Victoria, but to also increase the number of meals distributed to the homeless and hungry.

The data and calculator will also be useful for raising the general public's awareness of food waste, and hopefully provoke people to think about how they can reduce their environmental impact by reducing their food purchases and waste.

# 2 Introduction

FareShare (formerly named One Umbrella) was established in 2001, out of concern for the amount of waste within the food industry and food insecurity amongst the homeless. FareShare's vision is "A society where food is not wasted and hunger is minimised". FareShare has a small staff who are supported by over 3 000 volunteers a year, over 80 food donor organisations, corporate supporters such as nab, HBOS and GlaxoSmithKline and philanthropic trusts and donors.

FareShare collects unwanted and surplus food from organisations such as caterers, bakeries, hospitals, food manufacturers, markets and restaurants, and provides nutritious emergency relief meals for agencies catering to the hungry and homeless of Melbourne. FareShare provides two general types of emergency meals:

- value added meals – meals which FareShare prepares (cooks) from donated ingredients, such as single serve quiches from donated pastry, eggs and cheese
- non-value added food – ready to eat meals such as surplus sandwiches and rolls, muffins and pies.

In 2007–08 FareShare produced approximately 180 000 “value added” meals (weighing 61 tonnes) for people in need, and recovered and distributed a further 383 000 “non-value added” meals (193 tonnes). In 2008–09 FareShare is on track to produce approximately 500 000 value added meals, and supply the equivalent of a further 500 000 non-value added meals, a total of approximately 400 tonnes of food. The current target for 2009–10 is to provide 600 tonnes of emergency food.

The waste reduction associated with this large scale food recovery has a significant benefit for the environment. FareShare straddles issues of both hunger awareness and environmental sustainability, through the reduction of food wastage from the estimated 750 000 tonnes of food thrown out in Victoria annually.

Food recovery programs have existed for some time now and are acknowledged for their social and welfare benefits. The environmental benefits of food recovery programs are not as well understood.

The general objective of this report is to describe the review of available food Life Cycle Assessment (LCA) data to determine the environmental benefits of providing a meal using unsold or off-specification food (**recovered food**), versus the provision of the meal through standard channels (**standard food**), based upon the FareShare operations.

This analysis of the food LCA data is a significant component of the overall project goals, which are to:

1. Develop a report and strategy – identify and quantify current and potential food recovery, quantify the environmental gains achieved through food recovery and options for improvement, development of strategy for increasing food recovery and potential industry partners. Quantify the environmental gains that will be available for all food donor companies.
2. To produce a MS Excel based *Food Recovery Environmental Benefits Calculator*, for the ongoing determination of the environmental benefits of FareShare's food recovering and distribution activity. The Calculator incorporates the findings of the review and analysis of food LCA data, and allows the calculation of the impacts of meals across 40 different ingredients.
3. Contribute to the establishment of industry partnerships, including promotion of the findings and outcomes of the report to existing and prospective industry partners to secure additional food donors and corporate supporters. It is anticipated that corporate motivation will increase when individual companies can quantify the environmental achievements resulting from their involvement.
4. To increase levels of recovery of food, and subsequently increase the environmental gains achieved through recovery of food.
5. To increase the number of meals distributed to the hungry and homeless.
6. Contribute to Victoria's sustainability targets of reducing Victorian's greenhouse gas emissions by 60% by 2050 below 2000 levels, and the target of a 1.5 million tonne reduction in the projected quantity of solid waste generation by 2014.

It is hoped and anticipated that quantification of the environmental benefits of food recovery programs will substantially increase the perceived social and environmental value of this practice, and thereby increase the participation of the industry and retail sectors.

In the long-term, it is hoped that industry participation in food recovery programs becomes mainstream behaviour.

The environmental benefits of FareShare's activities primarily arise from the avoided consumption of food elsewhere, by emergency meal recipients, should they have not received the emergency meal. Generally, if FareShare did not intervene to recover the surplus food it would be disposed to landfill. So the emergency meal recipient would have to source food from elsewhere, requiring that additional production of food. Assuming the emergency meal recipient did not go hungry, then for every meal FareShare provides, it avoids the environmental impacts of producing a second meal.

In real life a significant proportion of recipients do go hungry if they are not provided a meal by the agencies FareShare supplies with meals and unprepared food. FareShare estimates that two thirds of meal recipients would typically go hungry if not provided with an emergency meal. This information is incorporated into the analysis of the environmental benefits of FareShare's activities, so as to not overstate the environmental benefits of FareShare's food recovery program.

The flowchart in Figure 2-1 shows how food travels from its production origins through to either consumption or waste disposal. The example chosen is a pie.

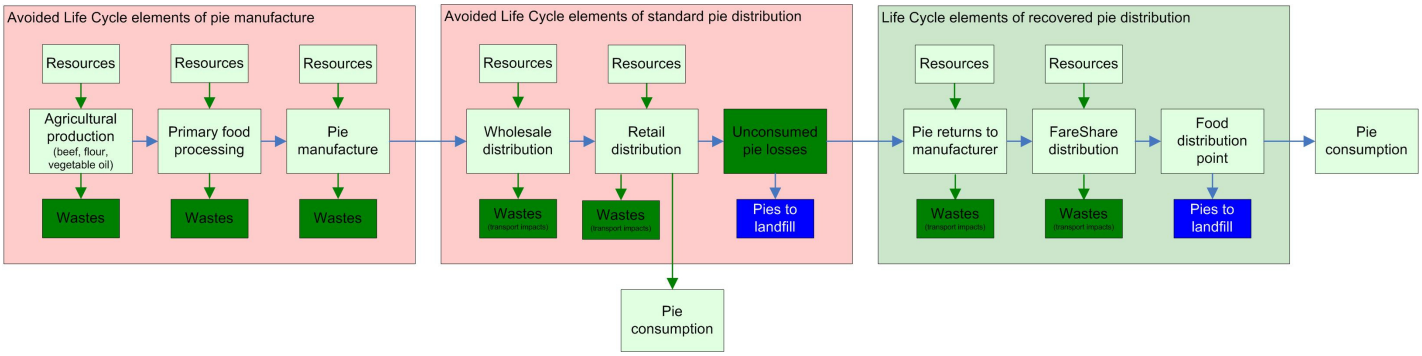


**Figure 2-1 FareShare Life Cycle flowchart – for non-value added pie**

Within the actual modelling and reporting it is assumed that the consumer would have eaten a meal (unless they went hungry) that has an equivalent environmental impact to the FareShare provided meal, should they have not received the FareShare meal.

The environmental benefits of recovered food were determined across the following four indicators:

- **greenhouse benefits** (units – kg $CO_2$eq and equivalent refrigerators switched off for one year)
- **energy savings** (units – kWh and number of refrigerators annual energy consumption)
- **water savings** (units – kilolitres and number of households annual water consumption)
- **landfill savings** (units – cubic metres and number of households annual landfill generation)

This report also provides an overview of the MS Excel based *Food Recovery Environmental Benefits Calculator* development process. The Calculator will be used on an ongoing basis by FareShare to determine the environmental benefits of its recovery of food, either in terms of:

- a single meal
- the large scale donation of a single ingredient by a benefactor
- FareShare's overall monthly and annual activity.

# 3 Method

## 3.1 Food LCA data analysis outline

### 3.1.1 LCA background

Life Cycle Assessment (LCA) is a technique for assessing the environmental impacts associated with a product over its life cycle. LCA approaches are increasingly being used to assess the environmental performance of products and systems. This approach models the environmental impacts from each stage of a product's lifecycle across raw materials acquisition, manufacture, product use and end-of-life.

### 3.1.2 Goal and scope definition

The goal of this study is to determine the environmental benefit of providing a meal using unsold or off-specification food (**recovered food**), versus the provision of the meal through standard channels (**standard food**).

Each meal modelled has its ingredient inputs limited to those that will dominate the life cycle impacts. For example, the main ingredients for a typical meat pie are; flour, meat, vegetables, vegetable oil (or possibly animal fat) and water. These ingredients are modelled in the lifecycle, with any other ingredients assumed to have the same average impact as the main ingredients.

Shown in Figure 2-1 is the standard food provision lifecycle, and the recovered food lifecycle, which connects to this. Recovered food may be unsold/excess food from retail or other operations such as hospitals or events. It also includes unsold or off specification produce from markets and food manufacturers.

The red areas of the flowchart are the *avoided* elements of the FareShare lifecycle. As the pie would otherwise have gone to landfill, another pie (or equivalent) would have been required to replace it to provide the meal to the consumer. That is, *two pies* would be required to provide the meal to the consumer (of the recovered pie), if FareShare *did not* recover the pie (or its ingredients) destined for landfill and subsequently provide it to the consumer.

The green area of the flowchart are the environmental impacts of FareShare's activity.

The benefit of FareShare's activity is the green area (a positive or actual impact), less the red areas (negative or avoided impacts).

It has been identified that for a significant proportion of meals provided (two thirds), no meal would otherwise have been consumed by the meal recipient. For this proportion of meals provided (where otherwise no food would have been consumed) the life cycle and environmental impact of FareShare's activity will be limited to the green area of the flowchart, i.e. *FareShare's activity has a net impact upon the environment*.

## 3.2 Food LCA data analysis and calculator development

The completion of a single, scientifically rigorous, LCA for an individual food ingredient from the farm to the consumer, is a massive undertaking, and the completion of 40 (or more) of these was well beyond the available budget and scope of this project. Fortunately, extensive pre-existing LCA work in this area has been completed and was available through the following LCA databases:

- LCA food DK database (primarily data for Denmark and Western European conditions)
- Australian Data 2007 database (data for Australian conditions, often modified from international sources)
- Eco-invent 2.0 database (primarily data for Swiss, Western European and USA conditions).

Data for the 40 major ingredients contained in the food FareShare distributes, both value added and non-value added, was sourced from the three LCA databases above. A full list of the 40 ingredients, and the source databases, is presented in Appendix A.

The food LCA data in the above databases was generally available up to the point of wholesale distribution. However, the environmental impact of the recovered food across the entire food recovery lifecycle covers the following general areas:

- farm production impacts
- food processing (and transport to food processing) impacts
- wholesale transport and storage
- retail transport and storage
- FareShare processing and transport impacts
- consumption impacts.

To enable an approximation of the full lifecycle impacts of food supply, a literature review was undertaken to identify the respective impacts of each stage of the lifecycle, for each food ingredient, for each impact category.

The primary sources for this data of full life cycle impacts were:

- Manchester Business School (2006), *Environmental Impacts of Food Production and Consumption – A research report completed for the Department for Environment, Food and Rural Affairs by Manchester Business School*. Manchester, UK.
- Heller, M. and Keoleian, G. (2000), *Life Cycle-Based Sustainability Indicators for Assessment of the U.S. Food System*. Center for Sustainable Systems, University of Michigan, Michigan, US
- Larsen, K, Ryan, C and Abraham, A (2008), *Sustainable and Secure Food Systems for Victoria: What do we know? What do we need to know?* Victorian Eco-Innovation Lab, University of Melbourne, Melbourne, Australia.

The life cycle data for each of the 40 food ingredients was collated up to the wholesale (or in some cases the farm gate) point of the food lifecycle. The impacts of food supply up to the point of consumption were then approximated from the review of the impacts of the full lifecycles, provided in the three references listed above. This allowed the full life cycle impacts to be approximated for the four impact categories (global warming potential, embodied energy, embodied water and landfill impacts).

It is worth noting that *food miles* can be a useful indicator of environmental impact, particularly when comparing the transport related impacts of similar products from different locations. As this study assessed the benefits of avoided consumption of food sourced from what was assumed to be the same location for any given ingredient, it was not considered a necessary parameter to incorporate into the Calculator. In addition, the usage of food miles is still in its early stages of development, and there is little food mile related, ingredient specific data, to be found in the literature.

Other key aspects of the life cycle approximation and calculator development were:

- The use of the method outlined in the document “Department of Climate Change (2008) *National Greenhouse Accounts (NGA) Factors*, January 2008” to estimate the greenhouse gas emissions for methane for landfilled organics. The calculated GHG impact was 0.6993 kg CO2-eq per kg of food landfilled, and assumes a national recovery rate of methane of 26% at landfills.
- It was assumed that environmental impacts of delivering a meal to the point of consumption is the same as the sum of the impacts of delivering the individual ingredients to the point of consumption (including food processing and cooking), i.e. meat or vegetables are processed and cooked with similar impacts regardless of if they are consumed as a single ingredient, or combined with other ingredients.
- It was assumed that the environmental impacts of FareShare’s preparation of value added meals was the same as the environmental impacts of the typical primary food processing step.

- Due to the lack of Australian specific water consumption data across the full lifecycle of virtually all food ingredients, the following general water split across the different stages of the life cycles of food was adopted: on farm (75%), processing/packaging (10%), wholesale distribution (2.5%) retail distribution (2.5%) and consumption (10%). This split is a rough synthesis of information found in MBS (2006), Heller (2000) and Larsen (2008), and the sector splits for water consumption in Victoria, and provides a general approximation to the actual life cycle water impacts. Water consumption to the farm gate or wholesale level was drawn from the LCA food DK database.
- It was assumed that where food may have gone to other destinations for human consumption, rather than to landfill, that this would be to applications that would not fulfil a market demand, or for maintaining buffer stock inventory levels, and so would still result in a net greater demand by emergency meal recipients elsewhere in the economy, and thus the requirement for greater food production.

Key conversion factors used in the calculator are present in Table 3-1.

**Table 3-1 Key conversion factors**

| Factor | Conversion value |
|---|---|
| Refrigerator $CO_2$ emissions | 0.65 tonnes $CO_2$/fridge/year |
| Refrigerator electricity consumption | 500 kWh/fridge/year |
| Household domestic water consumption | 234 kilolitres/household/year |
| Per capita domestic water consumption | 93.5 kilolitres/person/year |
| Household garbage yield | 500 kg/household/year |

# 4 Results

The estimated avoided impacts of FareShare's activity during the 2008–09 financial year are summarised in Table 4-2 below.

**Table 4-2 Total avoided environmental impacts due to FareShare's estimated activity in 2008–09 – assuming 33% of emergency meal recipients would otherwise source food elsewhere**

| Impact category | Value | Unit |
|---|---|---|
| **Greenhouse gas impact** | -620 000 | kg $CO_2$eq |
| | -953 | annual refrigerators GHG impact |
| **Energy impact** | -934 000 | MJ |
| | -519 | annual refrigerators energy consumption |
| **Water impact** | -22 500 | kilolitres |
| | -96 | annual households water consumption |
| **Landfill impact** | -365 | $m^3$ |
| | -730 | annual households landfill yield |
| **Total weight of recovered food** | 400 000 | kilograms |

Note: negative values denote an avoided impact.

On average, every kilogram of food that FareShare recovers results in a saving of 1.5 kg $CO_2$ emissions and saves 56 litres of water.

Based upon the FareShare analysis, it is interesting to identify the benefits of food recovery where it does result in 100% avoidance of food consumption elsewhere (i.e. emergency meal recipients do not go hungry if they do not receive a FareShare meal). For this hypothetical situation every kilogram of food recovered results in a saving of 6.6 kg $CO_2$eq emissions, and saves 220 litres of water. These values are probably much closer to the typical (non-FareShare life cycle) environmental impacts of food.

**Table 4-3 Total avoided environmental impacts due to FareShare's estimated activity in 2008–09 – assuming 100% of emergency meal recipients would otherwise source food elsewhere**

| Impact category | Value | Unit |
|---|---|---|
| **Greenhouse gas impact** | -2 626 000 | kg $CO_2$eq |
| | -4039 | annual refrigerators GHG impact |
| **Energy impact** | -5 658 000 | MJ |
| | -3143 | annual refrigerators energy consumption |
| **Water impact** | -88 233 | kilolitres |
| | -378 | annual households water consumption |

The estimated food use by FareShare in 2008–09 is given in Table 4-4.

**Table 4-4 2008–09 estimated recovery of food ingredients and non-value added meals, with breakdown by sub-ingredients and alternative destinations**

| Primary ingredient or meal | Weight of recovered food (kg) | Sub-ingredient 1 | | | Sub-ingredient 2 | | | Sub-ingredient 3 | | | Sub-ingredient 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination |
| Zucchini/Silverbeet | 9 600 | Vegetable - zucchini | 60% | Landfill | Vegetable - zucchini | 40% | Stockfeed | N/A | 0% | N/A | N/A | 0% | N/A |
| Apples/Pears | 5 800 | Fruit - apples | 50% | Landfill | Fruit - apples | 50% | Stockfeed | N/A | 0% | N/A | N/A | 0% | N/A |
| Onions/Spinach/Tomatoes | 15 300 | Vegetable - onion | 50% | Landfill | Vegetable - onion | 50% | Stockfeed | N/A | 0% | N/A | N/A | 0% | N/A |
| Potatoes/Sweet potatoes | 19 200 | Vegetable - potato/sweet potato | 40% | Landfill | Vegetable - potato/sweet potato | 60% | Stockfeed | N/A | 0% | N/A | N/A | 0% | N/A |
| Mangoes/Paw Paw | 3 800 | Fruit - mangoes | 50% | Landfill | Fruit - mangoes | 50% | Stockfeed | N/A | 0% | N/A | N/A | 0% | N/A |
| Bananas | 15 300 | Fruit - bananas | 60% | Landfill | Fruit - bananas | 40% | Stockfeed | N/A | 0% | N/A | N/A | 0% | N/A |
| Eggs | 5 400 | Egg - whole | 100% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Olive Oil | 1 900 | Other - canola oil | 40% | Landfill | Other - canola oil | 60% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A |
| Bread Flour | 7 700 | Cereal - flour | 70% | Landfill | Cereal - flour | 30% | Stockfeed | N/A | 0% | N/A | N/A | 0% | N/A |
| Meat – beef and lamb | 46 000 | Meat - beef (round) | 100% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Pasta | 38 400 | Other - pasta | 100% | Other human | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |

| Primary ingredient or meal | Weight of recovered food (kg) | Sub-ingredient 1 | | | Sub-ingredient 2 | | | Sub-ingredient 3 | | | Sub-ingredient 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination |
| | | | | consumption | | | | | | | | | |
| Lentils and Chickpeas | 19 200 | Vegetable - legumes | 100% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Milk | 17 300 | Dairy - milk | 100% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Butter | 7 700 | Dairy - butter | 100% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Ham and Bacon | 6 900 | Meat - ham | 100% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Fish | 400 | Meat - fish | 100% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Cheese | 14 600 | Dairy - cheese | 100% | Other human consumption | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Sandwiches and Rolls | 7 700 | Bakery - roll | 30% | Landfill | Meat - ham | 30% | Landfill | Vegetable - mixed vegetables | 20% | Landfill | Dairy - cheese | 20% | Landfill |
| ISS Meat Dishes | 5 800 | Vegetable - mixed vegetables | 50% | Landfill | Meat - chicken | 20% | Landfill | Meat - beef (round) | 20% | Landfill | Bakery - bread | 10% | Landfill |
| ISS Desserts | 2 700 | Bakery - pastry | 50% | Landfill | Dairy - cream | 20% | Landfill | Dairy - butter | 10% | Landfill | Other - sugar | 20% | Landfill |
| Salads | 200 | Vegetable - | 50% | Landfill | Vegetable - | 50% | Landfill | N/A | 0% | N/A | N/A | 0% | N/A |

| Primary ingredient or meal | Weight of recovered food (kg) | Sub-ingredient 1 | | | Sub-ingredient 2 | | | Sub-ingredient 3 | | | Sub-ingredient 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination | Ingredient name | % by weight of primary/meal | Alternative destination |
| | | spinach | | | tomatoes | | | | | | | | |
| Cooked Vegetable Dishes | 11 500 | Vegetable - mixed vegetables | 100% | Landfill | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Sauces | 3 800 | Other - tomato sauce | 100% | Landfill | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| Muffins | 1 000 | Cereal - flour | 40% | Landfill | Other - sugar | 25% | Landfill | Dairy - milk | 20% | Landfill | Egg - whole | 15% | Landfill |
| Other largely packaged food-ingredients | 122 700 | Other - pizza dough | 60% | Landfill | Other - tomato sauce | 10% | Landfill | Dairy - cheese | 20% | Landfill | Meat - bacon | 10% | Landfill |
| Pastry | 10 300 | Bakery - pastry | 100% | Landfill | N/A | 0% | N/A | N/A | 0% | N/A | N/A | 0% | N/A |
| **Total** | **400 200** | | | | | | | | | | | | |

In summary, the findings of this analysis of the benefits of food recovery are:

- The estimated benefits of FareShare's food recovery activities in 2008–09 (400 tonnes) is the:
  - avoided emissions of 620 tonnes $CO_2$eq or the annual equivalent of switching off 953 refrigerators for a year
  - an energy saving equivalent to the annual energy consumption of 519 refrigerators
  - a water saving equivalent to the annual water consumption of 96 households
  - a saving in landfill disposal equivalent to the annual generation of 730 households.
- On average, every kilogram of food that FareShare recovers results in a saving of 1.5 kg $CO_2$eq emissions and saves 56 litres of water.
- Every kilogram of food that is recovered, assuming the ideal case where it substitutes fully for the consumption of one kilogram of food elsewhere in Victoria, provides an approximate saving of 6.6 kg $CO_2$eq emissions and saves 220 litres of water.
- Assuming that 10% of the 750 000 tonnes of food thrown out in Victoria each year is off-spec or 'close to used by date' food and could be recovered through an organisation such as FareShare, then the potential environmental benefits of its recovery are savings of 113 000 tonnes $CO_2$eq or the annual equivalent of switching off 173 078 refrigerators, and 4.2 GL of water or the annual water consumption of 18 000 households.

The project has also included the development of an MS Excel based Food Recovery Environmental Benefits Calculator, for the ongoing determination of the environmental benefits of FareShare's food recovery and distribution activity. The Calculator incorporates the findings of the review and analysis of food LCA data, and allows the calculation of the impacts of meals containing four main ingredients, across 40 different selectable ingredients.

The quantitative outcomes of this life cycle based analysis of the environmental benefits of food recovery will be used to contribute to the establishment of industry partnerships, including promotion of the findings and outcomes of the report to industry partners to secure additional food donors and corporate supporters.

It is anticipated that this will assist in increasing levels of recovery of food, and subsequently increase the environmental gains achieved through recovery of food. A key outcome of this will be to not simply decrease the environmental burden of food production in Victoria, but to also increase the number of meals distributed to the hungry and homeless.

# 5 References


**1** Australian Data 2007 database (data for Australian conditions, often modified from international sources).

**2** Eco-invent 2.0 database (primarily data for Swiss, Western European and USA conditions).

**3** Heller, M. and Keoleian, G. (2000), *Life Cycle-Based Sustainability Indicators for Assessment of the U.S. Food System*. Center for Sustainable Systems, University of Michigan, Michigan, US.

**4** Larsen, K, Ryan, C and Abraham, A (2008), *Sustainable and Secure Food Systems for Victoria: What do we know? What do we need to know?* Victorian Eco-Innovation Lab, University of Melbourne, Melbourne, Australia.

**5** LCA food DK database (primarily data for Denmark and Western European conditions)

**6** Manchester Business School (2006), Environmental Impacts of Food Production and Consumption – A research report completed for the Department for Environment, Food and Rural Affairs by Manchester Business School. Manchester, UK.

**7** Mr M Godinho (FareShare) provided details of FareShare's 2007–08 and estimated 2008–09 food recovery, by e-mail, on 8 July 2008.

# Appendix A

## List of ingredients

| Ingredient grouping (ingredient name) | LCA database source |
|---|---|
| Bakery (bread) | LCA Food DK Database data |
| Bakery (pastry) | LCA Food DK Database data |
| Bakery (roll) | LCA Food DK Database data |
| Cereal (flour) | LCA Food DK Database data |
| Dairy (butter) | LCA Food DK Database data |
| Dairy (cheese) | LCA Food DK Database data |
| Dairy (cream) | LCA Food DK Database data |
| Dairy (milk) | LCA Food DK Database data |
| Egg (whole) | LCA Food DK Database data |
| Fruit (apples) | LCA Food DK Database data |
| Fruit (bananas) | LCA Food DK Database data |
| Fruit (mangoes) | LCA Food DK Database data |
| Fruit (pears) | LCA Food DK Database data |
| Meat (bacon) | LCA Food DK Database data |
| Meat (beef (round)) | LCA Food DK Database data |
| Meat (beef mince) | LCA Food DK Database data |
| Meat (chicken) | LCA Food DK Database data |
| Meat (fish) | LCA Food DK Database data |
| Meat (ham) | LCA Food DK Database data |
| Meat (pork mince) | LCA Food DK Database data |
| Meat (sausage mince) | LCA Food DK Database data |
| Other (canola oil) | LCA Food DK Database data |
| Other (pasta) | LCA Food DK Database data |
| Other (pizza dough) | LCA Food DK Database data |
| Other (seasoning) | LCA Food DK Database data |
| Other (sugar) | LCA Food DK Database data |
| Other (tomato sauce) | LCA Food DK Database data |
| Other (water) | Australian (VIC) delivered data |
| Vegetable (carrot) | LCA Food DK Database data |
| Vegetable (corn) | Ecoinvent data |
| Vegetable (legumes) | LCA Food DK Database data |
| Vegetable (mixed vegetables) | LCA Food DK Database data |
| Vegetable (onion) | LCA Food DK Database data |
| Vegetable (peas) | LCA Food DK Database data |
| Vegetable (potato/sweet potato) | LCA Food DK Database data |
| Vegetable (rice) | Ecoinvent data |
| Vegetable (silverbeet) | LCA Food DK Database data |
| Vegetable (spinach) | LCA Food DK Database data |
| Vegetable (tomatoes) | LCA Food DK Database data |
| Vegetable (zucchini) | LCA Food DK Database data |