Victorian food organics recycling

A guide for small-medium food services organisations

VICTORIA State Government | Health and Human Services

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Introduction

In Victoria each year we recover approximately 31,000 tonnes of food waste. While this is a significant amount, it represents only three per cent of the total tonnage of food waste generated each year.[1]

Restaurants, hospitals, aged care homes, fruit and vegetable markets all handle food, and all contribute to organic waste. For the retail and hospitality sector, organic waste can be as much as 4.5 tonnes per employee per year, and around 78 per cent of total waste to landfill.

This guide is for people who manage food operations in organisations that provide food services, such as hospitals, aged care providers, hotels, cafes, restaurants and food courts in shopping malls. It will help you work out ways to reduce food waste going to landfill, potentially save costs, reduce negative environmental impacts including greenhouse gas emissions, and become leaders in recycling.

There are different types of food waste, and the best solution for you depends on the type and quantity of waste, and the space you have. All these factors are covered in this guide. Food waste ranges from crates of edible fruit and vegetables to food scraps from customer plates, food from preparation areas and unsold quality food.

In the last decade there has been rapid growth in food recycling around the world. People are now more aware of the cost of such waste plus the high environmental cost of food decomposing in landfill. There are benefits too, including social benefits in donating edible food to charity groups and environmental benefits of adding compost to soil and returning it to the food cycle.

To make your decision easier, this guide covers:

- capital and operating costs of technology options
- ways to save operational costs
- different technologies, cost to purchase, time, space, staff and skill requirements
- what goes in and what comes out
- case studies
- steps to success and things to avoid.

Food recycling can be split into two broad treatment categories; on-site and off-site. Within these categories there are six options for your consideration include:

- food waste that goes to someone else's site:
  - food donation to charities
  - separate bins for commercial treatment
- handling food waste at your premises:
  - worms (vermiculture) for compost
  - drying via dehydration unit to reduce food load weight and provide soil fertiliser
  - composting via an 'in-vessel' compost unit
  - anaerobic digestion units to produce biogas for energy and digestate.

This guidance covers each of these options. However, new processes and technologies are regularly being developed for organics management and readers are encouraged to do further research as necessary to ensure that all possible options are being considered.

[1] Sustainability Victoria 2015, *Statewide waste and resource recovery infrastructure plan Victoria 2015–44*, p. 78.

Broadly, technologies fit into the following categories:

- biological treatment – systems using microorganisms to process organics
- thermal treatment – systems using heat to treat organic material, however it must be further treated
- thermal-biological – systems that use microorganisms as well as heat to treat organic material
- storage – systems that treat organic material to extend the period for which materials can be held, however it must be further treated
- processing for disposal – systems that process organic material and dispose them to sewer or tanks that are pumped out for processing at other sites.

The installation of any on-site treatment of organics should be discussed with your water retailer as it may affect your, or result in the need for, a trade waste agreement. For example, the removal of organics from your trade waste, by no longer using insinkerators, may result in a reduction in trade waste costs, while the disposal of organic material through the sewer may increase trade waste costs.

Regardless of whichever category and option is chosen, the broad process and decision points, which are outlined in this document, should not substantially differ. All potential technologies should be adequately considered to ensure you get the best system for your specific circumstances.

Why recycle waste food?

Governments, businesses and people are taking action because they want to:

- reduce food waste being disposed to landfill
- get value out of food waste including compost and energy
- cut greenhouse gas emissions from food decomposing in landfill
- feed vulnerable people by providing edible food through food charity groups.

Food conservation and recycling in different jurisdictions

Worldwide

Food conservation and recycling is going global. The 2007 UK Love Food Hate Waste program is now global and has been adopted in Australia.[2] The program covers portion size, storage and recipes with left-over food, and it helps family budgets and tackles over-purchasing and bad habits.

Governments are also lifting the bar on food waste. In France restaurants have known since 2013 that they must stop sending food to landfill by mid-2016 or pay fines, and in 2015 laws were passed requiring supermarkets to sign contracts for food donations.[3] Since 2015, Vancouver has imposed a fine of 50 per cent on top of disposal costs when food is found in general waste bins for all buildings (including healthcare, retail and restaurants).[4]

Australia and Victoria

A number of councils in Australia are including food organics in kerbside recycling collection services. In Victoria these include Nillumbik Shire Council, Moonee Valley and Moyne Shire Council, and others are doing trials with their communities, such as Brimbank, Wyndham and Bendigo.[5] Many are also encouraging home composting.

In October 2015, the Victorian Government released a strategy specifically on organics.

Victorian organisations already recycling food include:

- Ballarat Health Services
- Barwon Health
- Cecconi's Restaurant
- Crown
- Melbourne Cricket Ground
- Melbourne Health
- Melbourne Town Hall
- Peninsula Health
- University of Melbourne
- Western Health
- Zoos Victoria.

[2] See http://www.lovefoodhatewaste.vic.gov.au/.

[3] *The Guardian* 2015, 'France to force big supermarkets to give away food to charities', 23 May 2015.

[4] Metro Vancouver 2015, 'About food scraps recycling'.

[5] Hyder 2012, *Food and garden organics best practice collection manual*, Commonwealth Government of Australia.

How do you compare in generating food waste?

It is now easy to compare your quantities, efficiency and productivity using an expert study commissioned by the Victorian government in 2012–13[6]. This data on food and organic waste has also been calculated proportionate to the number of full-time equivalent (FTE) employees for each sector.

The final column of Table 1 shows the proportion of organic waste (food, garden and other organic material) to landfill from each sector which could be diverted for recycling or treatment. Your figures may be different, but it gives a good idea of how much you could cut from your waste to landfill by recycling food and other organic material.

Table 1: Typical organics (food and garden) waste and recycling quantities per sector

Victorian sector	Organic waste generated per FTE per annum	Organics recycled per FTE per annum	Organic waste going to landfill per FTE	Organics as proportion of total waste to landfill (per cent)
Food and beverage service	4,510 kg	1,100 kg	2,660 kg	78
Retail food trade businesses (supermarkets, grocery stores and specialty foods)	3,350 kg	1,430 kg	1,310 kg	68
Health care and social assistance businesses	660 kg	510 kg	30 kg, or 0.2kg per bed-day	23
Accommodation service businesses	6,170 kg	2,000 kg	2,480 kg (food and garden/green)	59

Some facts on food waste

There are major factors behind all the fuss over food waste. The expert Victorian study found that 589,000 tonnes of food from commercial and industrial premises went to Victorian landfills in 2011–12 and only 69,000 tonnes (11 per cent) was recycled. This is the lowest recycling rate among all materials. It is lower than plastic packaging at 23 per cent and glass packaging at 47 per cent. Almost more food went to landfill than all other recyclable materials combined.[7]

At an estimated median input cost of $5,500 per tonne, the cost and loss of food discarded from commercial and industrial businesses alone in 2011–12 was $332.4 million. Food is equal to the highest-cost material inputs in the Victorian economy, alongside non-ferrous metals, leather, textiles and rubber.

Other relevant facts about food waste include:

1. Food ‘waste’ is typically heavy because it is wet or dense. Fruit, vegetables, meat, chips, cakes, coffee grinds – all have high moisture content, while sugar, flour and grains are dense. In professional studies, food is stated at 400 kilograms per cubic metre – as heavy as glass – whereas office paper is 150 kilograms per cubic metre. Cost for general waste collection per 240 litre bin is approximately $9 per bin. If you pay waste fees based on weight, rather than by bin collection, it makes good sense to lighten your load by recycling food waste.

[6] Sustainability Victoria 2013, *Waste flows in commercial and industrial sector report.*

[7] Sustainability Victoria op. cit., p. 23.

2. When food decomposes in landfill it can leach liquid that requires capture and treatment by the landfill operator prior to disposal. Around 500 kilograms of leachate is generated per tonne of food waste sent to landfill.[8] This could be higher or lower dependent on local rainfall.
3. When we send waste food to landfill, we also waste the resources it took to get that food from paddock to plate, which includes growing, processing, transport, refrigeration and cooking.
4. When we produce, transport and send to landfill one tonne of food, we generate 0.42 tonnes of carbon dioxide gas. If recycled, the emissions are cut by 60 per cent to 0.17 tonnes CO^2-e.[9]

For all these reasons it is very important to recycle food.

Paying for and changing food waste fees

The majority of general waste collection fees include the following factors in the cost structure:

- weight of the load
- number and size of rented bins (10 x 240 litre vs 2 x 1,100 litre bins)
- number of bin lifts
- frequency of collection, for example daily or weekly.

When you change these factors, you can negotiate a new deal with your waste management supplier. As Table 1 shows, if you are a typical food and beverage business, about 78 per cent of the weight of your bin is organic waste. The remainder is plastic and broken items that are probably lighter and will not decompose in landfill. This is one reason why more and more food outlets are recycling food so they have less frequent, and smaller and lighter general waste collections.

To check out how your costs could change, use the online food waste calculator[10]. The calculator is based on generic data and may not relate to your specific circumstances.

Recycling innovation transforms precinct – Degraves Lane Melbourne

Degraves Lane, Centre Place and the surrounding precinct is a busy, vibrant part of the central city with a high density of small cafes, bars, restaurants and retail outlets. In 2013, it was charming, had stylish grunge and 'potential', but was tainted by a smelly, untidy mess of dumpster garbage bins that resulted in litter, vermin and poor access. There was no recycling of any kind and everything went to landfill. Each business had separate bins and collections, so there were many truck and bin movements throughout the day.

Figure 1: Degraves Street in Melbourne

Source: http://www.visitvictoria.com/Regions/Melbourne/Destinations/Laneways/Centre-Place-and-Degraves-Street

[8] The Hills Shire Council, 'Food Waste'.

[9] Sustainability Victoria op. cit., p. 26.

[10] <https://www2.health.vic.gov.au/hospitals-and-health-services/planning-infrastructure/sustainability/waste/organic-waste>

An audit by the City of Melbourne identified that collectively these businesses were producing approximately 700 kilograms of food waste per day, and almost 90 per cent of their waste was recyclable – cardboard, bottles and mostly food.

The City of Melbourne decided to take the lead and innovate. They negotiated access to a neighbouring ground-floor car park and set up a recycling area for bins and a dehydration unit to service all businesses.

Costs for the trial: The cost for the total program including dehydration unit, neighbouring site access, new bins, training, coordinator to set up project was $423,000.

The project delivered multiple benefits by changing the waste system including:

- transforming public access, safety and amenity
- cutting smells, rubbish and vermin
- improving working conditions for businesses
- cutting waste to landfill by 67 per cent from 4,630 kilograms in 2012 to 1,573 kilograms in 2014
- cutting the volume of food waste collected from participants in the trial by 68 per cent
- cutting the number of bins, trucks and accident hazards.

Ready reckoner

Table 2 shows the range of options to suit different sites, workplaces and situations. Key details for each option are covered in the following pages.

Table 2: Ready reckoner summary on options

Descriptor	Off-site use – sent as donation to charities	Off-site treatment – sent to commercial operators	Worm farm	Dehydration unit	In-vessel composting	Anaerobic digestion
How much food processing kg/day	Min @ 50 kg	Unlimited, more than 30 kg p/day	From 2–60 kg/day	From 50–1,200 kg/day	From 85–2,400 kg/day	From 1,000–55,000 kg/day
Typical unit size specifications (L x W x H) m	Refrigeration and/or transport containers	120 litre or 240 litre bins	From .55 m x .55m x .8 0m up to 3 m x 2 m x 2.5 m	From 1.05 m x .75 m x 1.3 m up to 3.3 m x 1.8 m x 2.05 m	From 5.5 m x 1.3 m x 1.8 m up to 12.8 m x 2.1 m x 2.3 m	From 200 m^2 to 3,500 m^2
Weight of unit (kg)	None	None	12–150 kg	370–3,500 kg	250–950 kg	Not available
Buying the unit ($AUS)	None	Bin hire or purchase	$380–$21,500	$35,000–$220,000	$55,000–$380,000	$450,000–$5.75 million
Operating the unit	None	Collection fee	None	$4–$6 per load to $75–$80 per load	From $1.40 per load	From $5.00 per load to $200,000/a
Power sources: two or three-phase power and/or gas	Refrigeration for stored food	None	No power required	Three-phase power and/or gas	Three-phase power	Three-phase power and/or gas
Staff operations **Staff expertise and time that is, one full-time equivalent (FTE) employee**	Separation	Separation	Relatively easy, like home worm farm ~1 hour/batch	Basic training Time: ~30mins to load and unload unit/batch	Specialised training and staff Time: 0.2–1.0 FTE	Specialised training and staff Time: 0.2–1.0 or more FTE
Discharges; process water – trade waste and/or air emissions via flue	None	None	All material goes as nutrient to soil	Process water to trade waste, possibly flue for air and/or gas	All material goes as nutrient to soil	Air discharges via biofilter
End products	Quality food for people	Depends on contractor	Worm vermicast and juice	Soil conditioner, condensate and heat	Compost and heat	Digestate, biogas and heat
End product use options	Feeding other people	Offsite treatment such as compost, worms	Dilute juice for garden watering and castings for soil	Use on gardens and blended with compost	Garden, soil blending and landscape	Digestate for soil, biogas for electricity, heat exchanger

Steps to start and tips for success

In this section we give you:

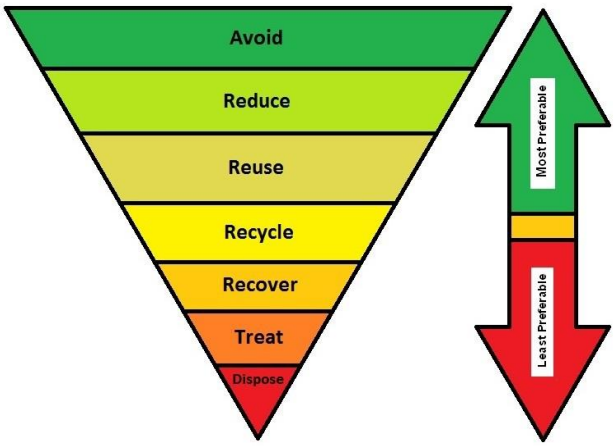
- hierarchy decision tool for efficiency
- steps to build support for food recycling
- basic facts on costs
- steps to engaging with suppliers
- what food you can recycle
- other benefits.

Use the waste hierarchy to improve your efficiency

A useful first step is to conduct a waste audit to better understand the types of waste you produce and what can potentially be diverted from landfill. Waste auditing is not difficult and there is also lots of practical online guidance if you don't mind getting your hands dirty. Alternatively, your waste contractor, or a specialist waste auditor would be able to conduct a waste audit.

Use the waste hierarchy before you select any recycling option or sign contracts – it could save you.

Figure 1: The waste hierarchy



Source:http://www.moira.vic.gov.au/Environment/Reducing_Our_Ecological_Footprint/Purchasing_Consumption_and_Waste

1. Avoid (don't purchase food if you won't use it, or it won't last)
2. Reduce (donate to food charity, make a casserole)
3. Reuse (reuse bones, skins for a soup)
4. Recycle (separate food for worms) and so on, to the last and least preferable
5. Dispose to landfill.

Pin this diagram on your fridge, by the phone where you order supplies and use it at team meetings so it guides your decisions.

Go through these steps to ensure you do not over-order food and that you have systems in place to reduce food waste, so that whatever food recycling system you put in place is correctly sized for your operations and budget.

The waste hierarchy is used around the world because it is the best guide to help make decisions on investment, waste and recycling. The UK's 'Love Food Hate Waste' and the Victorian 'I love leftovers' campaigns both use this waste hierarchy.

Steps to build support in recycling food

Recycling food will not work if you do not have support from those involved – principally your staff and to an extent your customers. People's decisions and participation are based on both rational facts and emotions. Support can be won over time if it is not there already. It is not enough to tell people the facts, you must involve, collaborate and empower your team. The IAP2 Participation Spectrum is a good guide.[11]

Depending on the individuals it may mean they do some of the following:

- Separate and set aside one day of food waste from other waste and recycling and see the impact. Food may be heavier and bigger volume than anything else.
- Inspire passion and empathy by getting a food charity to present to the staff.
- See what a leader or competitor is doing.
- See where it goes: visit a landfill and some food recycling facilities.
- Calculate the equivalent actions that would have to be taken to get the same reduction in carbon emissions and water savings (see the costs section below).
- Get views and commitments from customers or suppliers on food recycling, climate change, gardening and soil nutrition.

As support is gained and systems are set up, you can take further steps:

- Set up separate caddies in the kitchen to start food separation, even if it still temporarily goes into general waste bins and then landfill.
- Tell more people about your food recycling plans, and generate ideas, enthusiasm and ownership.
- Celebrate ideas and innovation of others, crown someone the 'food recycling champion' for the week.
- Rotate the food recycling champion/monitor role between staff to ensure everyone gets to see contamination of bins or systems.
- Incorporate food recycling and waste monitoring and data into team meeting reports.

Basic facts on costs

Most food premises in Victoria have more than 50 per cent of their waste bins full of food and organic material. As Table 1 shows, an expert study in 2012–13 found that the majority of bin contents could be diverted for composting and benefit society, the economy and the environment. If diverted, then far smaller and less frequent bin collections are needed.

Here is an example of a typical restaurant, open Tuesday to Sunday, generating waste at 600 kilograms per 100 square metres of floor area per day.

[11] International Association for Public Participation 2014, IAP2 Public Participation Spectrum.

Table 3: Typical changes by introducing food recycling

Typical restaurant (50 m^2)	Before recycling organics	Once recycling organics
Waste to landfill (kg/day)	300 kg	140 kg
Number of 240 L waste bins (weighing average 35 kgs/bin)	9	5
Cost of waste service $9/240 L bin	9 bins x $9/collection = $81/day	5 bins x $9/collection = $45/day
Food donated to charity (kg/week)	0	50 kg
Food and organics for other recycling	0	110 kg
Recycling food collection costs $13/120 L bin (~weight 30 kgs/bin)	0	4 bins x $13/collection = $52/day
Total cost/day (Note other key benefits include reduced food to landfill, carbon savings, reduced odour & vermin)	$81/collection/day	$97/collection/day

As shown above, the introduction of a food organics collection bin service and food donation to charity will significantly reduce the amount of food organics disposed to landfill. While there will be an increase in the bin collection charges, there will be significant environmental and social benefits from the diversion of food organics from the general waste stream. All food premises reported in the case studies that their sites were cleaner, there were fewer vermin and less litter, which makes for a better place for workers and customers.

To calculate your own costs and financial benefits use the food waste calculator.[12] The calculator is based on generic data and may not relate to your specific circumstances.

Waste management quotes and contracts

When you change your waste or recycling loads, you should negotiate changes to your contracts. This might be for changes to the number or size of bins, days of collection, type of collection, that is, food in green organics bins. If your current contractor cannot provide a food organics recycling collection service you can investigate the option of using another contractor for the collection of your food waste for recycling.

Your waste management contractor should give you a monthly report detailing the number of general waste and food organics bins collected, kilograms diverted from landfill and other environmental matters such as greenhouse gas emissions. This will help you track your progress or any issues you may be charged for, such as contamination.

When negotiating a quote for general waste services, lock in a set rate for at least 12 months. If you are signing a contract for two or more years, lock in set rates for collection and bin rentals. Check also the length of notice required for changes to contracts. Some companies require notice in writing at least 90 days prior to expiry of the contract for any changes to come into effect in the next contract period. If you do not provide this request to cease or change the contract in writing at least 90 days before the contract expiry date, then the waste contract may automatically roll over into a new contract period.

Further advice on best practice waste and recycling contracts is available from Sustainability Victoria.[13]

[12] <https://www2.health.vic.gov.au/hospitals-and-health-services/planning-infrastructure/sustainability/waste/organic-waste>

[13] <http://www.sustainability.vic.gov.au/services-and-advice/business/recycling/copy-of-how-to-guidance>

Other benefits – reputation and branding

Leading food outlets use food recycling to bolster their brand and reputation as good citizens. As you start your food recycling journey, it is important to celebrate with others – unless you are one of the last to make the transition.

You may find the profile, reputation, brand and staff morale are greater value than any financial savings you make. Here are some ideas:

- Cross-promote with your food suppliers and customers.
- Put a notice in your window or public area, a footer on your email.
- Invite the local media to see how it works and promote it on social media.
- Provide serving staff a badge that says ‘Food recycling champion’.
- Celebrate the anniversary of when you started food recycling.

What can I recycle?

Aside from donating quality food to charities (which must be fit for human consumption), there are many things you can include in your food recycling system.

Your food recycling service provider will give you precise information on what is best, but we have included a general list of what you can and cannot include in worm farms, organics bin collections and dehydrators.

Food you can recycle

- Fruit and vegetable scraps
- Bread, rice, pasta, cereals
- Paper and cardboard, especially shredded paper
- Raw and cooked food
- Dairy products
- Lawn clippings
- Meat, poultry and bones
- Paper towel and tissues
- Weeds, leaves, bark and small plants
- Fish and other seafood
- Flowers and floral arrangements (minus wire, foam and ribbons)
- Garden pruning’s and small branches
- Tea leaves, tea bags, coffee grounds (not coffee capsules)
- Vacuum cleaner dust and dirt
- Unpainted natural small timber such as firewood, cold ash
- Eggs and egg shells
- Sawdust
- Compostable bags

Food you cannot recycle

- Cigarette butts
- Fabric napkins, table cloths
- Cleaning products, sponges, mops
- Cooking oil

- Food containers such as cans, waxed paper boxes, chocolate aluminium foil, plastic bags
- Paper with sticky tape, twine or string
- Dead animals (except in anaerobic digestion processes)
- Treated or painted timber
- Biodegradable bags

Other issues for consideration

Nitrogen drawdown

One of the benefits of some technologies is that the volume and weight of the food waste is significantly reduced by drying the organic material. This reduces transport costs for waste collectors. The end product is not always classified as compost and may need to be taken to an organics processing facility to be further processed to meet Australian Standard 4454: Composts, soil conditioners and mulches.

When organic material that is not broken down is added to a garden, micro-organisms, bacteria and fungi start to breakdown and compost the material. In doing so, these organisms draw nitrogen from the soil, competing with the needs of the plants. This is called nitrogen drawdown. In order to avoid this, the organic outputs may need to be first composted before adding to the garden.

Compostable vs. Biodegradable bags – What's the difference?

It is important to understand the meaning of 'compostable' and 'biodegradable' because they are not equivalent. If you wish to use bin liner bags as part of your food organics recycling system, then only Certified Compostable Bags should be used.

There is often confusion about the difference between compostable and biodegradable bags. Biodegradable bags are not compostable and only break down into smaller pieces of plastic, so can have a negative impact on the commercial composting facilities that process bagged food waste and the environment.

Certified Compostable Bags, on the other hand, are manufactured using plant-derived starch based polymers that break down completely – returning all nutrients to the soil without leaving any harmful residues. To find Certified Compostable Bags, look for those that are certified to Australian Standard AS4736-2006, easily identified by the 'seedling logo'.

Food organics recycling options

Sending food off site to charities

Costs: Free collection / staff time: minimal / skill: no new skills required / equipment: refrigeration

There is a growing network of food donation charities distributing food to people in need.

Rescued food is currently a small proportion of total food recycled. This option is a win–win for all and the best outcome for quality food.

In 2014–15, one charity, Foodbank, provided more than 40 million meals to people in need across Australia thanks to food donations, and a Victorian operation provided in one day enough boxes of food for 300 families for a week. There is more demand than supply, with nearly 25 per cent of Australians living in low-income households, and 10 per cent in poverty. Food charities report they turn away 60,000 people (homeless, plus aged, single parents and the working poor) every month due to lack of food and resources.[14]

Food donation is a good option if you have sufficient quantities of quality food on a reasonably regular basis that cannot be sold or served in time. You might choose to donate the best surplus food and have a second arrangement for the residual food, such as a worm farm. Food donation can work for all kinds of food outlets, whether you are a wholesaler, retailer, food manufacturer, caterer, bakery, restaurant or cafe.

Typically food charities have a core small staff team, volunteer drivers and sorters, and provide employment to people with a disability, at risk or trying to get back into the workforce. The charities are discerning about the food they collect, all of which has to be sorted at a warehouse/refrigerated premises for further distribution to many other charities/agencies who feed people in need.

Food charities will not collect poor-quality food not suitable for human consumption.

Size: Some big charities specify a minimum of 50 kilograms per pick up. Local charities may have smaller quantities and be willing to have occasional collection.

How it works: You approach and establish an arrangement with a food donation charity. To make it easy, charities typically have a standard online donor enquiry form where you can list products to be donated, and an 1800 number. Collection from your premises is free, and if agreed, you can deliver directly to the charity.

Inputs: There are sensible criteria for food donation. High-risk food (meat, eggs, dairy) must not have been stored outside the temperature danger zone (above 5 degrees Celsius). This means you must have sufficient temperature-controlled storage until collection takes place.

Charities require clearly labelled food, stored in the required temperature zone, handled by people and stored in premises with high standards of hygiene and cleanliness. Food must have at least two days life remaining, and ‘best before’ dates must have two days remaining for refrigerated products. There are other specifications for dry products and perishable products.

Outputs: These food donation charities sort and prepare food to the requirements of hundreds of diverse charities, who in turn give your food to people in need. The food is either cooked and served as meals, or combinations of ingredients, for example carrots, celery and fruit will be boxed to give to families. The programs operate on quick turnaround, good relationships and good will.

[14] Foodbank 2015, ‘The facts’.

Connecting people with food

Food charities work cooperatively together to cover areas where people live.

'Receiving those food parcels gave me an opportunity for social interaction with the volunteers and other people in a similar situation to me. From there I started to build my confidence, and then I started to volunteer myself and meet more people. Now, moving forward, I'm at uni completing a degree. I've come a long way and Foodbank has played an enormous role in my achievements.' Bel, Foodbank Victoria

'Without the assistance of Second Bite's Community Connect program, Ballarat Community Health APROTCH would not have the opportunity to provide free cooking programs which allow us to educate clients (who have a diagnosis of serious mental illness) on nutrition, budgeting and increase their confidence in preparing meals in their own home. Also we will not be able to provide our clients with fresh fruit and vegetables on a weekly basis.' Vivian Pasani, Ballarat Community Health

'Many of our young people run out of money to buy food just a week after they receive income support. One young person, who we'll call Britany, attended our training programs regularly and her enthusiasm to attend and excel in our programs was incredible. On many occasions she was reduced to tears as she was unable to pay her bills and buy food. We were able to use Second Bite's goods to send food parcels home with her whenever she needed help.' Kate Conforti, TOOL

Sending food off site to recycling

Costs: ~$13.00/bin / Staff time: Minimal / Skills: segregate food / Equipment: 120 litre food bin

As you have arrangements for collection of bottles and cardboard for recycling, you can pay for food to be recycled by a collector and processor. The collector will empty wheelie bins at your site and take the contents to a site where your food will be mixed and processed with other material for compost or soil conditioner.

This off-site system is good if you do not have room on your site for worm farms or specialist units, or do not want to handle food recycling and the output product of compost or soil conditioner.

Size: Collectors will provide you with bins, generally either conventional 120 litre or 240 litre bins. These are stored in an area that can be easily accessed by the collector's truck. They are emptied ready for you to fill them.

How it works: You and your team deposit only organics in the specially supplied organic bins and collections are scheduled as required according to your loads, such as every day or twice a week. You will be charged according to the frequency of collection and number of bins picked up, so it makes sense to have full bins rather than many half-empty bins. Your food waste is collected by special food organics trucks, taken to a processing facility where it is composted and then either sold as compost or mixed with soil and sold as a blended product.

Inputs: If it didn't grow, then it cannot go in the food recycling bin. Discuss with your service provider any variations to the list in the 'Food you can recycle' section. Generally you can deposit any type of food in the bins – vegetables, meat, fish, fruit, grains, coffee grounds, flowers and soiled paper napkins. Depending on your service provider and the destination you should not dispose of any cooking oil or wrapping such as plastic wrap, aluminium foil and waxed cardboard in the off-site food recycling bin. Cooking oil can be collected separately by a cooking oil recycling company at no cost to the business.

Outputs: Under this system, you do not retain any food material on your site as compost or soil conditioner. All material goes off site for processing elsewhere. Generally the food waste will be recycled into compost as an Australian Standard AS-4454 compost product at a facility licensed by the Victorian Environment Protection Authority.

Costs: This system offers convenience at an ongoing operating cost and no capital cost. You should offset the ongoing cost by changes to your general waste contract. Costs will vary depending on the number of bins and frequency of collection. You will be charged extra if your bins contain contaminating products such as cigarette butts, plastic or bottles that have to be removed at a cost to the collector, or if loads have to go to landfill.

Staffing: Staff will require training on what is recyclable and what is contamination, but thereafter there is minimal effort required to fill bins. If there is contaminating material in your bins, costs will go up and you may need to retrain staff. We recommend having a staff champion to lead the program. Arrangements would need to be made on cleaning the bins, getting rid of the dirty water and keeping the collection area clean so it does not attract vermin, or create odour issues.

Size and space: Space requirements will be for recycling bins in your yard area, and for dedicated food recycling bins internally, such as kitchen caddies and mid-sized bins. Minimise the risk of mistakes by putting the bin in the best spot, with labelling, signs and diagrams.

Equipment: The only specialist equipment you need are clearly designated bins for food in your kitchen and yard. Wheelie bins should have a green lid as per the Australian Standard. This removes confusion for all.

Feed worms on your site

Costs: ~$150-$21,000 / Staff time: 1 hour/day / Skill: Layering food waste / Equipment: Worm Bin

Worms are natural food recyclers and live in enclosed stacking worm farms. They digest, burrow and turn over food, creating two natural products: worm juice and worm manure (castings). These two products are great for gardens and return all the food nutrients plus extra nutrients and bacteria from the worms back to the soil.

This on-site system is good if you have a comparatively small amount of material, for example, two kilograms a day, and you have somewhere to put the worm manure and juice, such as a garden or vegetable patch, or give to staff or a community garden.

Size and space: Worm farms range from small home-scale systems with 1,000 worms (0.5 m x 0.4 m unit) that consume up to 500 grams a day, to large commercial operations with many millions of worms that produce juice, manure and also grow worms to sell as bait to fishermen. Generally 2,000 worms in a farm (0.6 m x 0.6 m unit) receiving 10 kilograms a week of a good balanced diet from a café (salads, meat, bread, grains and tea/coffee grounds) will produce 10 kilograms of worm manure and four litres worm juice a month. The worm farm at Healesville Sanctuary processes 400 kilograms a week of waste from animals, the garden and catering food.

Figure 3: Worm farm at Healesville Sanctuary, Zoos Victoria

How it works: A worm farms uses a mix of worms (not just the kind found in your garden), and concentrates them in a lidded container with the food as feed and a drainage outlet for the worm juice. Typical worms are: red wrigglers, white worms and earthworms. Worms will gradually multiply to meet

food supply and die off if there is insufficient food supply, or it is too dry, too wet or too hot. They live in balance with the environment you provide. The worm farm material needs to be turned over occasionally with a garden fork.

Typically, worm farms comprise multiple stacks of boxes or chambers, with most worms eating and living in the top food-deposit box, and leaving the lower box for your manure harvesting. In some worm systems, you move the newly emptied bottom box to the top, ready to receive food. The worms gradually migrate to the top box when they finish digesting the food in the lower box.

Inputs: Worms will process all types of food and organic material. This includes fruit, vegetables, breads, starches, proteins, paper napkins, straw, shredded paper and dry leaves. Worm farms are not suited to large quantities of citrus or onions, or to dairy, meat and oils that attract flies and vermin. There is no need for electricity, plumbing or permits from your council or the Environment Protection Authority unless you are going for a large system over 100 tonnes a month.

Outputs: Worm manure (also known as castings, vermicast, worm humus or worm poo) is a highly active biological mixture containing bacteria, enzymes, remnants of plant matter and animal manure, and worm cocoons (while damp). As the material has already been digested and processed by the worms, it is water soluble, unlike animal manure or chemical fertilizer, and is more concentrated than the food that went in.

When the worm farm is full (weekly or monthly), you remove the worm manure with a spade. It can be packed in lidded buckets and shared with staff and customers, or food suppliers such as vegetable growers. It can be applied directly on plants to soil. Roughly two kilograms of food input each day will yield 10 kilograms a month.

The liquid that drains from the worm manure is rich in nitrogen, bacteria and liquid minerals and trace elements for immediate plant take-up. Roughly two kilograms of food input a day will yield approximately four litres a month (less during warm weather). It can be bottled and shared with staff and customers, or food suppliers such as vegetable growers. Dilute one part worm juice to 100 parts water, and water plants, repeating every six weeks to three months.

Costs: A basic worm farm with 1,000 worms sells at around $150 from hardware and nurseries. More ergonomic farm units with a frame are ~$350. Some worm farm suppliers also undertake monthly health checks, providing written reports, advice and showing actions that will improve worm farm production. This may be useful during the early establishment phase.

Staff: Staff must be trained on what food is suitable food for worms, what to look out for in terms of signs of stress or overflow, and what to do in response. Removing the worm manure is basic gardening using a spade, gloves and bucket with lid. Worm juice is removed by filling bottles. No special safety equipment is required.

It’s a drug for our plants! Café worm farms, Stevenson’s Lane, Melbourne

In 2014–15 the City of Melbourne sponsored a trial of four worm farms and support services to two cafes/restaurants next to Stevenson’s Lane in central, Melbourne. This service is part of the council’s Love your Laneway program for businesses and residents to improve amenity.

Ben Bocock, of Section 8 Bar says, ‘I absolutely love my worms, love the concept, love the change to our laneway, love the plants. I feed the worms twice a week, talk to them and they give me bounty. Once a month their worm juice and castings go straight onto the plants out the front, and the next day you can see the herbs pick up, it’s like a drug for them! We feed the worms food scraps from the kitchen plus 50 per cent shredded paper (our newspapers and some cardboard). Our kitchen rules: no meat, citrus, onion, pineapple or tomato, and minimal bread and starches. It’s a great initiative by the council that has changed our operations and I now have a worm farm at home too. I like to think that people will pick a garnish from the planter box, get romantic and hey, years to come have family and a garden too!’

Figure 4: Ben and Paul with their worms

The council commissioned the supplier to make a metal frame to lift and locate the worm farms in a neat row, with the worm juice buckets on the ground below each bin. These sit near the planter boxes. As part of his monthly health check and written report, the supplier trains the café staff, measures temperature, pH levels, checks and adjusts the wet/dry composition of the farms. The City of Melbourne is considering ways to expand it.

Five handy hints for healthy worms

- Food and worms live in balance. Too much food and it may get slimy and smelly, too little and the worms will decline in number and not be able to handle sudden increase in quantities.
- Provide a balance of wet and dry ingredients. Wet ingredients include tea and coffee ground and fruit and vegetables; dry ingredients include shredded paper, cardboard, paper napkins, leaves and bread.
- Worms can have trouble with large items of food, like whole cabbages. Chop or process large material into smaller pieces. This will minimise food rot and sour smells.
- Keep the lid on the worm farm to stop flies, mice, birds and flooding from rain.
- Worms like moderate temperatures, not freezing cold and not in scorching summer sun. A hot mix will cook your worms.

Dehydrating units on site

Costs: $15,000–$220,000 / Staff time: ~30 minutes per batch / Skill: staff training / Equipment: dehydration unit

Removing moisture by dehydrating food waste results in a lighter load of dry biomass that is good for composts, gardens or incinerating to generate energy. Dehydrator units are an enclosed container that uses electricity or gas to heat and operate a motor that agitates the wet mix, while a fan removes moist air from the chamber. The heat, agitation and air flow cause rapid drying within 24 hours and a major reduction of around 90 per cent in both volume and weight. The finished biomass is not compost, but it is sterile and pasteurised. Dehydrators are good for both food and garden organic material.

Figure 5: A typical dehydration unit for 50 kilograms per day

Dehydration units make sense in locations where the waste collection cost is high, there is a reasonably consistent type of feed for the machine in moderate quantity, for example 100–6,000 kilograms per week, and it can be run five to seven days a week. While the unit does not need to operate continuously, it makes sense to maintain internal temperature with regular operation. For this reason it is suited to daily operations such as hotels, hospitality precincts, hospitals and accommodation facilities.

Size: Dehydrators come in different sizes to process varying quantities of food and organics. They range from units processing 10–1,000 kilograms per day. A small unit is approximately the following dimensions: L (105 cm) x W (75 cm) x H (121 cm), whereas a unit processing 1,000 kg per day is approximately the following dimensions: L (175 cm) x W (300 cm) x H (200 cm).

How it works: A dehydrator generally works with batch loads one or three times a day. You don't add food continuously. Food is loaded into one end of the machine, the lid is closed and the unit is turned on, and later the biomass is discharged at the far end of the unit. Internal temperatures are over 80 degrees Celsius, and typically a cycle takes up to 24 hours, but this may be less for dry and smaller loads.

Units range in weight from 370–3,500 kilograms and are stationary. They have internal rotating blades that move the contents along a cylindrical chamber to the opposite end, where it is either removed physically or ejected via a chute to a waiting container. It is absolutely essential that no metal objects such as kitchen utensils are in the input mix, as they can do serious damage or jam the blades and the motor. Moist air is removed by fans, and condensation results in greywater discharge.

Inputs: Dehydrators are good for all kinds of food and garden organic material, but not oil. Oil results in oily biomass, as it does not evaporate. The mechanical blade action will chop items such as potatoes, celery, and bunches of flowers, but large items such as whole pumpkins should be broken up for easier processing and uniform results.

The unit provider will advise on the recommended thickness of objects such as sticks, and the right mix of ingredients. A consistent mix of material (wet/dry) will mean easy standard operation, whereas large variations between batches will require adjustments to the operation.

Outputs: There are three outputs from dehydration units:

1. Biomass. The biomass is a dry and fine humus that smells earthy. There may be some small remnant bits of sticks or bones in the mix. This biomass is suited for compost or for application directly to soil at low levels where it will break down and release its nutrients. This material can also be sent to landfill at a fraction of the cost of wet unprocessed material, but it will still emit methane. It is also suitable for biomass combustion to generate energy.
2. Condensation. This greywater must be either discharged to the sewer or distributed to irrigate gardens. It must not be stored in containers.
3. Heat. These units generate heat, and depending upon size of your operation, you may want to capture the waste heat though a heat exchanger to make some other process more efficient, for example hot water.

Staff: Staff training on operating the machine is essential. This is in addition to training staff how to separate possible contamination from plastics or metal objects. Training will be part of the arrangement with the unit provider, who may also provide support after the unit is installed and commissioned, possibly for a 12-month period. Consider training a number of people simultaneously to use the unit, including detecting and rectifying basic problems.

Costs: Cost for the purchase of a dehydration unit will range from $15,000–$220,000, with an approximate electricity operating cost range of $4–$6 per load, up to $75–$80 per load. It is estimated that the labour time required to fill and empty each batch will vary from approximately 15–30 minutes.

Space and operating requirements: The unit must be on firm, absolutely flat ground such as a concrete slab. Dehydration units can use either mains electricity or gas to generate heat and run the

motors. Discharged greywater can be directed to the sewer or used for garden irrigation with a purple pipe. This greywater contains microbes that are fine to add to soil, but it must not be stored in containers. The unit needs to vent into open air, which means dehydrators are often located next to a building, in the service and/or utility area. If located in an enclosed area surrounded by walls, a flue may be required.

In-vessel composting on site

Costs: ~$10,000–$380,000 / Staff time: ~4–8 hours a day / Skill: specialised training / Equipment: in-vessel unit

In-vessel composting uses an enclosed vessel to speed up decomposition and energy (electricity or gas) for temperature control and monitoring. Some systems produce compost from food and garden waste to Australian Standard AS-4454, others produce a mixture called 'soil conditioner'. In-vessel composting requires less room than conventional open-air windrow composting.

You can select a system depending on the quantity and purpose of the compost material, as well as size and cost and also ambient climatic environment. They range in size from processing 85 kilograms a day to 2,400 kilograms day and technologies include rotating drums, containers, silos, agitated bays, tunnels and enclosed halls.

In-vessel composting systems make sense for sites with moderate to large and regular quantities of food and/or garden waste, such as major shopping centres, tourist venues (Melbourne Zoo), dairies and piggeries. They are generally larger than dehydrating units, handle larger quantities and greater contamination.

In-vessel composting is especially appropriate for places like shopping centres, where different businesses will handle input food material, because they are more robust than dehydration units at handling foreign objects such as kitchen cutlery or plastic plates. Although these objects will not damage the unit, they still need to be removed from the compost at the end of the process.

Size: Units available to the market in late 2015 can handle quantities ranging from 100–2,400 kilograms per day, which equates to 600 kilograms to 2.5 tonnes per week. Units with a design capability to process more than 100 tonnes per month require works approval from Environment Protection Authority, but none of the options considered here has a design processing capacity of over 100 tonnes per month.

The size of on-site in-vessel composting units ranges from : L (5.5 m) x W (1.3 m) x H (1.8 m) up to L (12.8 m) x W (2.1 m) x H (2.3 m).

Very large systems capable of composting up to 50,000 tonnes per year are being built to process Melbourne's food and garden waste. These typically are multiple rows of enclosed tunnel systems in a giant shed, where front-end loaders move tonnes of material from trucks into bays with subfloor vents and heating.

How it works: In-vessel composting works on large-scale batch processing, where material is loaded at one end and removed at the other. If a facility is operating on a large scale, there may be several bays of material processed in series. It is like dehydration, but it has an extended processing time – days or weeks rather than 24 hours. The purpose is to produce compost, not remove moisture.

In-vessel systems are generally automated, which means that handling is only required to add and remove the material, and the agitation and heating is done mechanically.

Inputs: Given that the purpose is to produce compost to be added to soil, the input mix is important to gain the right pH ratio. Facility operators usually establish arrangements with regular suppliers to get the right and consistent mix of input material, for example food, cellulose-rich material such as straw, nitrogen-rich material such as garden greens, and so on.

Winning leader: Hospital in-vessel composting unit, Barwon Health, Geelong

In recognition of their leadership, innovation and achievements in sustainability, Barwon Health won the Premier's Regional Sustainability Award in 2015. Bronwyn Aylmer, Waste Management and Cleaning Standards Coordinator says, 'Recycling food is one of the best things you can do to cut your greenhouse gas emissions. We have achieved a 100 per cent diversion of processed food.'

In 2011 Barwon Health commenced a trial, with state government and private sector unit provider funding, with a key objective to reduce greenhouse gas emissions by diverting food from landfill.

The first unit was too small and the second now processes 300 kilograms of food each day from 3,000 meals prepared at the McKellar Centre, Central Production Unit (in 2014–15 this equated to 167,572 occupied bed days). This includes food preparation and patient plate scrapings, but excludes food from public cafes.

The unit is located in the covered loading dock with a flue venting air and condensate through the roof, and a cage enclosing the hydraulic lifting arm for food bins. This is consistent with the existing general waste bins system and is not labour intensive. The hospital feeds the composting unit two batches every day and the humus is emptied once a week by turning a key to reverse the chamber paddles, causing humus to fall into an open plastic tub, which remains in situ until full.

The unit is leased with a monthly fee, and there are no servicing concerns or costs. While there is a small increase in financial cost for the waste and recycling system, there are many benefits. The site is now clean with no vermin, birds, scattered bins and food, a substantially reduced carbon footprint, and very high staff support as they saw this initiative as about doing the right thing rather than thinking only about costs. It has also connected the health service with the community – local community gardens and a winery come to the loading dock to collect the soil conditioner.

Six staff are trained to use the unit, but all staff are responsible for separating food, which has resulted in very low contamination. Significantly, a side benefit is that there has been an overall increase in recycling of other materials in the central production area. Previously a 4.5 metre skip of waste was collected every day – 31.5 cubic metres a week. This has been cut to three times a week, resulting in a weekly reduction of 22.5 cubic metres of waste going to landfill, which is a 71 per cent reduction.

Outputs: Depending on the retention time within the unit, the end product can either be a fertiliser or compost product. Not all units produce compost material to Australian Standard, so it is important to know the end purpose when selecting a unit.

As with dehydration units, there is a slight smell similar to fresh compost, so these units should be situated in a general utility or service area. The compost can be used directly in the garden, or it can be blended with soil as a soil conditioner.

Staffing: Staff training on operating the machine and system is essential. This is in addition to training in separating any possible contamination of the input material with plastics or metal objects. Training will be part of the arrangement with the unit provider, and may also involve support after the unit is installed and commissioned, for example, for a 12-month period. Consider training a number of people simultaneously to use the unit, including detecting and rectifying basic problems.

Costs: Purchase price for units handling 600 kilograms per week is around $10,000, and units for 2,500 kilograms per week is around $380,000.

It is estimated that the staff time required for loading and clearing the vessel per batch will vary from 1.5 hours to three hours per batch. Another benefit of the in-vessel technology is that, like the dehydration technology, once you load the unit it requires minimal monitoring and is a fully automated process.

Space and operating requirements: The unit must be on firm, absolutely flat ground such as a concrete slab. In-vessel composting units can use either mains electricity or gas to generate heat and run the motors. Discharged greywater can be directed to the sewer or used to irrigate gardens with a purple pipe. This greywater contains microbes that are fine to add to soil, but it must not be stored in containers.

The air from within the unit needs to be vented into open air, which means these units are often located next to a building, in the service and/or utility area. If located in an enclosed area surrounded by walls, a flue may be required.

Solving the landfill problem – Melbourne Zoo, Parkville

As part of its commitment to being a leader in sustainability Zoos Victoria Board set a goal to have zero waste to landfill by 2019. This stimulated innovation in many areas, including investigation of options for the large quantity of organic waste sent to landfill each year. Even after mulching a significant quantity of garden organics and animal bedding, this amounted to 800 tonnes per year.

Figure 6: In-vessel composting unit at Melbourne Zoo

Tom Meek, the Manager for Compost, Recycling and Waste at Melbourne Zoo described the options. 'We investigated a range of systems, included biogas plants, anaerobic digestion and windrow composting. However, the area available for collection and processing was not large, it was close to exhibits so odour control was important. Other factors were ease of use, application and saleability of final product and overall costs.'

The zoo purchased an in-vessel unit in 2012, with a five cubic metre feed hopper and a three cubic metre biofilter for approximately $380,000. Training was provided to all grounds and cleaning staff.

'With this unit we process one tonne (1,000 kilograms) a day of food waste from kitchens, food areas, animal enclosures and gardens. Over time, we have perfected the recipe for the feed mixture, ending up excluding the elephant manure because of high sand content from the elephant compound. The resultant compost is used on site and provided to a contractor who bags and sells it to nurseries and visitors at the zoo as Zoo Poo.'

Landfill and waste costs have reduced with the lower number of general waste collections from the zoo.

Anaerobic digestion

Costs: ~$450,000–$5+ million / Staff time: ~4–8 hours/day / Skill: specialised training / Equipment: anaerobic digestion unit

Anaerobic digestion is the most complicated of the options for processing food waste and expert advice is recommended if you are considering such a system for your site and operations. Whereas this technology may not be suitable for the majority of businesses, it is being included in this guidance for completeness.

Anaerobic digestion relies on microorganisms eating their way through biodegradable material in the absence of oxygen to produce three outputs: biomass, methane-rich biogas that can be combusted to generate energy, and heat. The resulting biomass material is generally wet sludge that can be used as soil conditioner.

Given anaerobic digestion systems are the most expensive and technologically advanced of the options, in Australia they are most likely to be found on large industrial sites that process more than 20,000 tonnes of organic waste per year. In such instances, key requirements are for consistent quantities and type of feedstock, as found in intensive agriculture of piggeries or dairies and sewage treatment plants where there is also a benefit in having constant energy and/or heat supply. You can use this energy and heat for improved efficient production, or in boilers for steam. Issues such as grid connection or on-site energy storage are important for the economics of anaerobic digestion systems.

Anaerobic digestion technology has been very popular in Europe for the past 30 years, with many large commercial plants established to treat a range of organic waste streams including food organics, bio-solids and animal manures. There has been increased interest in Australia to cut greenhouse gas emissions, as well as the recognition that anaerobic digestion systems provide base-load constant and renewable energy – indeed they capture methane that could otherwise go to the atmosphere.

Size: Anaerobic systems tend to be large for economy of scale given the high capital cost. They range in size processing 350–55,000 kilograms per day. The large systems occupy whole fields or very large building floor areas, such as 3,500 square metres. The small innovative and bespoke system at Federation Square in Melbourne fits into the loading bay, less than 220 square metres.

How it works: Anaerobic digestion systems are chemistry in action. The microorganisms eat the organic material and produce biogas and heat. While the microorganisms eat the organic material and break it down to a rich sludge, the biogas needs to be scrubbed clean of hydrogen sulfide so that it can be used to run a gas-fired generator to produce electricity. The system requires energy to run motors, fans and agitating blades to mix the sludge mixture, which can come from the generator.

Inputs: The organic material may comprise animal manure, vegetables, meat, green organics, oils and so on. The system works best with a consistent type and quantity of feedstock. The microorganisms will flourish in good conditions and suffer with inconsistent or toxic feed such as cleaning agents with high levels of salts.

Outputs: The system produces soil conditioner, methane biogas that can be captured for energy generation, and heat that can be captured in heat exchangers to improve efficiency of other systems such as boilers, heaters.

For the system at Federation Square, Melbourne part of its purpose and objective in installing a bespoke anaerobic digestion plant was to push innovation and lead industry. This system remains the smallest of its kind in operation.[15]

Staffing: Anaerobic digestion systems require people with training and understanding of the mechanical system, the chemistry, the variability of inputs and corrective measures. This can be learnt through training and application with systems. Qualified, full-time staff will be required to operate and monitor large systems.

Costs: Capital cost of systems start from $450,000 and exceed millions for large systems. Operating costs will be principally labour, with occasional maintenance, for example once per year. Depending whether the system will be connected to the electricity grid, there may be grid connection costs and feed-in tariffs (rebates). The economics of anaerobic digestion units is strongest in regional/rural areas where grid electricity supply may be unreliable or expensive due to load and transmission constraints.

[15] YouTube video on Federation Square

Federation Square anaerobic digestion

The anaerobic digestion unit at Federation Square in Melbourne treats up to 800 kilograms per day of food scraps from the precinct's restaurants and cafes to generate biogas and recover nutrients.

The plant operates 24 hours a day and apart from loading food waste into the system and cleaning, the unit is fully automated. The biogas is used on site for a boiler connected to Federation Square's hot water system. Once the organics are fed into the plant via 80 litre wheelie bins, it is heated to 44 degrees Celsius and can produce up to 14,400 litres of gas per day.

Figure 7: Anaerobic unit at Federation Square

Typical food organics used for this unit at Federation Square includes salad, vegetables, chicken fat, brines, fish waste, pastries, coffee grounds and fried food. When the load is ready, the lid opens on the receiving tank, food waste is tipped in, and the macerator starts. Shredded food waste collects in the balance tank and the transfer pump pumps feedstock into the reactor tank. Gas is collected at the top of the reactor tank and supplied to the boiler.

Digested solids collect at the bottom of the reactor, which is removed for use on gardens or in composting. All excess water is disposed to the sewer in accordance with a trade waste agreement with the water authority.

The plant operates in a very busy loading dock at Federation Square with minimal impact on staff.

Glossary

Term	Explanation
Anaerobic digestion	Biological breakdown by microorganisms of organic matter, in the absence of oxygen, into biogas (a mixture of carbon dioxide and methane) and digestate (a nutrient-rich residue).
Biogas	A gas generated by breaking down organic matter in the absence of oxygen, such as occurs in landfills. Biogas is typically comprised of 60 per cent methane and 40 per cent carbon dioxide, and can be used as an energy source.
Biomass	Biological material that is not fossilised, including forest and mill residues, agricultural crops and waste, wood and wood waste, animal waste, livestock operation residues, aquatic plants, fast growing trees and plants.
Biosolids	Biosolids are considered to be organic solids derived from sewage treatment processes that are in a state that they can be managed to sustainably utilise their nutrient, soil conditioning, energy or other value (achieve minimum EPA standards for classification as T3 and C2 biosolids). The solids that do not meet these criteria are defined as sewage sludge.
Collection system	System for collecting materials from premises, including bin type and collection frequency.
Commingled recyclables	Materials combined generally for the purposes of collection, mainly through municipal collection services. Includes plastic bottles, other plastics, paper, glass and metal containers. Commingled recyclable materials require sorting after collection before they can be recycled. Can also be called commingled materials.
Commercial and industrial (C&I) waste	Solid inert waste generated from trade, commercial and industrial activities including the government sector. It includes waste from offices, manufacturing, factories, schools, universities, state and government operations and small to medium enterprises for example, food waste.
Composting	The process whereby organic materials are microbiologically transformed under controlled aerobic conditions to create a pasteurised and stabilised organic product for application to land.
Digestate	A nutrient-rich residue remaining after the anaerobic digestion of a biodegradable feedstock.
Energy from waste	The terms ‘energy recovery from waste’, ‘waste to energy’ or ‘energy from waste’ can be used interchangeably to describe a number of treatment processes and technologies used to generate a usable form of energy from waste materials. Examples of usable forms of energy include electricity, heat and transport fuels.
Environment Protection Authority	Established under the auspices of the *Environment Protection Act 1970*, EPA’s role is to be an effective environmental regulator and an influential authority on environmental impacts.
Feedstock	Raw material used to manufacture products. Material varies depending on what is being produced.
Food organics	Food waste from households or industry, including food processing waste, out-of-date or off-specification food, meat, fruit and vegetable scraps. It excludes liquid wastes.

Term	Explanation
Garden organics	Organics derived from garden sources, for example grass clippings, tree prunings. Also known as green organics.
Greenhouse gases	Gases, including carbon dioxide and methane that trap heat in the earth's atmosphere, affecting weather and climate patterns. Greenhouse gases are generally measured in carbon dioxide equivalents, or CO^2-e.
Incinerator	For the purpose of this document, a site that facilitates the disposal of waste streams through incineration without producing another useful end product or capturing value from the waste material.
In-vessel composting	Composting technology involving the use of a fully enclosed chamber or vessel in which the composting process is controlled by regulating the rate of mechanical aeration. Aeration assists in heat removal, temperature control and oxygenation of the mass. Aeration is provided to the chamber by a blower fan which can work in a positive (blowing) and/or negative (sucking) mode. Rate of aeration can be controlled with temperature, oxygen or carbon dioxide feedback signals.
Kerbside waste/ collection	Waste collected by local councils from residential properties, including general waste, commingled recyclables and garden organics, but excluding hard waste.
Landfill	Discharge or deposit of solid wastes onto land that cannot be practically removed from the waste stream.
Landfill levy	A levy applied at differential rates to municipal, commercial & industrial and prescribed wastes disposed of at licensed landfills in Victoria. Landfill levies are used for the purposes of environment protection and fostering environmentally sustainable use of resources and best practice in waste management. They fund the activities of Waste Resource & Recovery Groups, Sustainability Victoria and the Environment Protection Authority, helping to establish waste management infrastructure, industry waste reduction programs, education programs, regulatory controls and enforcement regimes. Levies also provide an incentive to minimise the generation of waste, sending a signal that the government supports efforts to develop alternatives to disposal to landfill.
Leachate	Contaminated water that has percolated through or drained from a landfill.
Open-windrow composting operation	A type of outdoor composting process where organic materials are piled in to windrows and turned for aeration.
Organic material	Plant or animal matter originating from domestic or industrial sources for example grass clippings, tree prunings and food waste.
Processing facilities	Facilities which either receive materials directly from collection systems or from recovery facilities for further sorting and/ or processing to provide material for use in the generation of new products.
Putrescible waste	Waste that readily decomposes, including food waste and organic waste from gardens.
Recycling	A term that may be used to cover a wide range of activities, including collection, sorting, reprocessing and manufacture into new products.
Reprocessor	Facility that changes the physical structure and properties of a waste material that would otherwise be sent to landfill to add financial value to the processed material. Without reprocessing the beneficial use of the material would be lost.

Term	Explanation
Residual waste	Residual material that remains after any source separation or reprocessing activities of recyclable materials or garden organics. Waste that is left over after suitable materials have been recovered for reuse and recycling. This generally means the environmental or economic costs of further separating and cleaning the waste are greater than any potential benefit of doing so.
Resource recovery	The process of obtaining matter or energy from discarded materials. Occurs at resource recovery centres.
Sectors, industry sectors	Groupings of industries used to generalise patterns in waste generation and disposal, for example construction and demolition, food services including food retail and food manufacturing, small to medium enterprises.
Source separation	The practice of segregating materials into discrete material streams prior to collection by, or delivery to, processing facilities.
Sustainability Victoria	Statutory authority established in October 2005 under the *Sustainability Victoria Act 2005* with the key objective of 'facilitating and promoting environmental sustainability in the use of resources'. Sustainability Victoria works across the areas of energy, waste and water with communities, industries and government applying the best ideas and encouraging action to enable change in environmental practices.
Three-phase power	A common method used around the world of generating, transmitting and distributing electrical power, particularly used by electrical grids to transfer power. It is used to power large motors and heavy loads.
Waste	Any discarded, rejected, unwanted, surplus or abandoned matter, including where intended for recycling, reprocessing, recovery, purification or sale. Anything that is no longer valued by its owner for use or sale and which is, or will be, discarded. In this document, the term 'solid waste' refers to non-hazardous, non-prescribed, solid waste materials ranging from municipal garbage to industrial waste.
Waste and resource recovery group	Statutory authorities established under the *Environment Protection Act 1970* responsible for preparing the Regional Waste and Resource Recovery Implementation Plan for their region.
Waste and Resource Recovery Planning Framework	The planning framework as defined in the amendments to the *Environment Protection Act 1970* and including: • The Statewide Waste and Resource Recovery Infrastructure Plan (SWRRIP) • The seven Regional Waste and Resource Recovery Implementation Plans (RWRRIPs) • Relevant Ministerial Guidelines made under section 50CA of the Act • The process for integration of the SWRRIP and RWRRIPs.
Waste management industry	Applies to those involved in managing waste, for example collectors, sorters, processors and landfill operators.
Waste minimisation	The concept of, and strategies for, waste generation to be kept to a minimum level in order to reduce the requirement for waste collection, handling and disposal to landfill. Also referred to as waste avoidance.