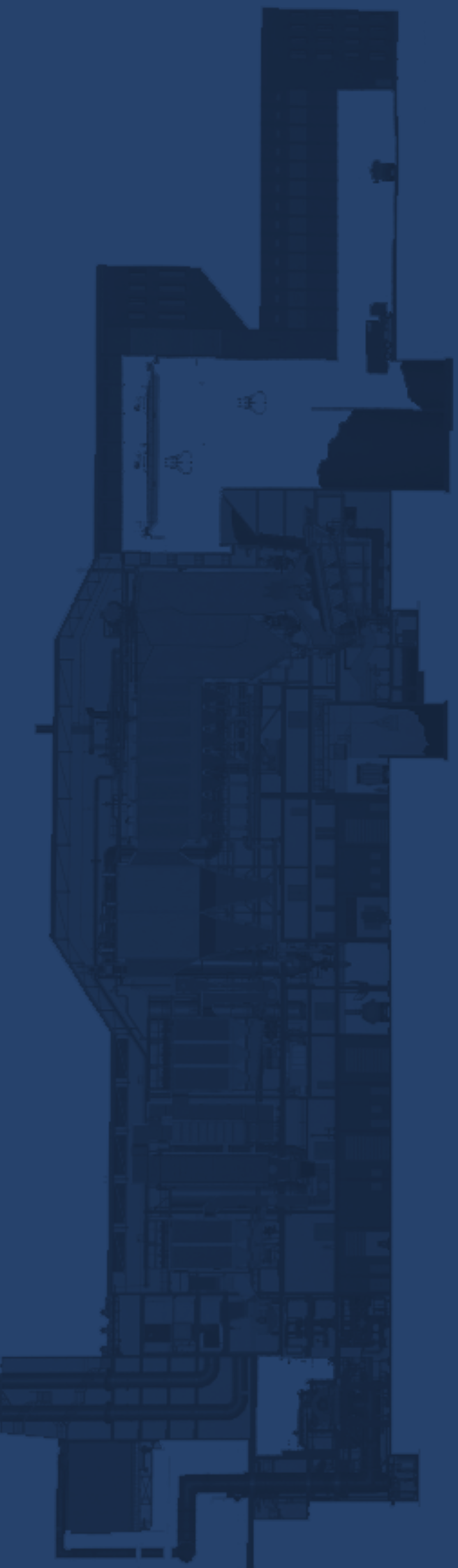

Wyndham Waste Education Tour

May 2018

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Contents

Executive Summary

In May 2018, Wyndham City undertook an Education Tour with the objective to see first hand how some of the world's best waste treatment and disposal sites operate.

The tour included visits to facilities in six countries across the UK and Europe as well as pivotal discussions with suppliers of services and technology at the IFAT Trade Fair in Germany.

Learnings from the tour will guide council in managing waste generated in Wyndham, one of the fastest growing municipalities in Australia. Wyndham City Council also operates the Wyndham Refuse Disposal Facility (RDF), one of Melbourne's largest commercial landfills.

Key findings from the waste education tour that are outlined in the body of the report are:

- **Cultural and Political Environment:** cultural and economic differences strongly influence waste management although the common direction is set by the European Union.
- **Implementing alternative waste disposal:** national and regional government policy is a key influence on waste disposal.
- **Alternative waste treatment and disposal options:** to replace landfill by effectively recovering materials and/or converting waste to energy.
- **Public and private ownership and management:** waste facilities are being developed by council and energy companies using waste as a fuel to generate heat and / or electricity for customers.

The waste education tour has provided a unique insight into what is happening in waste management and what is possible. Wyndham City has an opportunity to lead by example for both community and commercial waste disposal.

This report contains conclusions and recommendations for Australia to divert waste from landfill (as opposed to leaving it buried for future generations to treat) or transferring waste offshore for treatment. Action is required at the federal, state, and local level to develop a coordinated national waste management system.

There are also significant costs and risks in moving away from landfilling to alternative treatments of waste. Some key recommendations for Wyndham and more broadly include:

- National targets for waste avoidance
- Recovery of materials
- Converting waste to energy
- Direct investment for alternate waste treatments
- Joint Investment by councils
- Bale and wrap waste before placement into landfill

1. Introduction

Australia faces an unprecedented challenge dealing with waste generated by households in our cities. Melbourne is no exception and the remarkable growth in Melbourne's population signals that the problem will get worse before it gets better. There is a limited market for source separated materials and insufficient space for residual waste to continue going to landfill.

For local government to replace landfill as a waste disposal method this means that an investment of more than $1.0 to $1.8 billion is required – significantly more if commercial and industrial waste is included.

Wyndham is one of the largest and fastest growing municipalities in Australia and with more than 13,000 new residents forecast to arrive in Wyndham each year, the need for waste services will also grow.

Wyndham City operates one of Melbourne's largest commercial landfills. The Wyndham Refuse Disposal Facility (RDF) is one of five landfills accepting waste from metropolitan Melbourne. It currently accepts over 500,000 tonnes of waste, which includes municipal solid waste from councils and commercial and industrial waste from businesses. Approximately 10% of the waste received at the RDF comes from the Wyndham community.

The amount of waste received at the RDF is forecast to double to 1,000,000 tonnes over the next 10 years.

As a council and a commercial landfill owner and operator, Wyndham City has a unique understanding of the challenges facing Melbourne in disposing of waste.

The Wyndham RDF is ideally placed for waste treatment and disposal of residue located in the middle of the Werribee Junction Precinct. When the precinct structure plan is completed by the Victorian government, it will provide almost 1,000 hectares of industrially zoned land for green jobs.

Wyndham City's environmental and waste reduction targets include commitments to recover more resources from waste and to reduce the volume of waste going into landfill.

"The RDF Strategic Plan and Vision 2040 was adopted by Council in March 2016 commits Wyndham to reducing waste to landfill and finding innovative and best practice waste management solutions to create economic growth and green jobs."

"The RDF will become the centre of a precinct focussed on resource recovery, with residual waste to landfill. Complementary businesses are co-located and the area is a centre for economic growth and green jobs. The centre plays a key role in environmental education and is acknowledged by the community."

In May 2018, Wyndham City Mayor, Cr Peter Maynard, Director City Operations and Manager Waste Management and Disposal undertook an Education Tour to understand best practice in waste disposal. This included site visits and meetings that were held across the United Kingdom (UK), Spain, France, Italy, Germany and Switzerland with councillors, council officers, facility designers and builders, facility operators, technology suppliers, and thought leaders.

2. Education Tour

2.1. Objective

To gain an understanding of the experiences of leading countries and to see first-hand how some of the world's best waste treatment and disposal sites operate.

The learnings will guide Council in managing waste generated by the Wyndham community and in managing waste received at the Wyndham Refuse Disposal Facility (RDF).

2.2. Rationale

This region was selected because:

1. It is the most mature market in the world for materials recovery from waste, energy from waste, and minimising waste to landfill
2. Companies have been designing, making and operating alternative waste treatment facilities for over 150 years
3. Communities in northern Europe have high levels of waste diversion from landfill and accept alternatives to disposal of waste to landfill

Sites visited were selected to learn from the experience of councils and commercial waste facility operators across the UK and Europe and included old and new technologies, public and private ownership and management.

The UK has undertaken significant investment to reduce reliance on landfill and has set targets for materials recovery and taxed landfill to encourage investment in alternatives. Investment in waste treatment facilities has accelerated over the last 20 years.

Australia is in a similar position to that of the UK 20 years ago.

2.3. Overview

- The delegation visited six countries, ten facilities, and held meetings with three thought leaders
- The operation of facilities was discussed with five public and three private operators
- Five major waste treatment and disposal technologies were reviewed in detail
- Discussions were held with more than 20 suppliers of services and technology during the site visits and at the IFAT Trade Fair
- The views of politicians, customers, facility owners, builders, and operators were canvassed.

Locations visited in the UK, Spain, France, Italy, Germany, Switzerland (in that order) are highlighted on the map below:

United Kingdom
- Leeds Recycling and Energy Recovery Facility
- Allerton Waste Recovery Park
- Milton Keynes Waste Recovery Park
- Greatmoor Waste to Energy Facility
- Ferrybridge Multifuel Energy-from-Waste Plant

France
- Cross Wrap (Finland)
- Montblanc Landfill (Bessan)

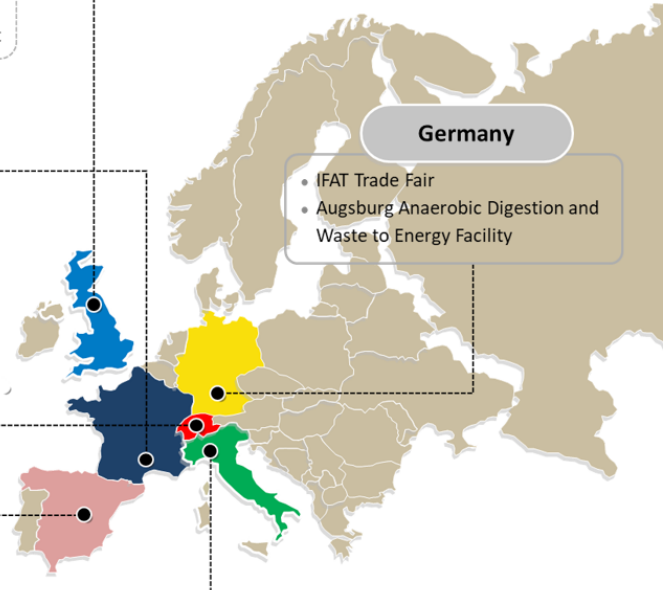
Switzerland
- Winterthur Anaerobic Digestion Plant
- Renergia Waste to Energy Plant

Spain
- Ferrovial Centre of Excellence
- Ecoparque de Toledo

Italy
- Indro Edil Landfill (Imperia)
- Mondial GIS
- Macpresse Europa

Germany
- IFAT Trade Fair
- Augsburg Anaerobic Digestion and Waste to Energy Facility

The schedule of meetings, list of participants and list of organisations and people met are in the attachments.



3. Key Findings

Cultural and political environment

Cultural and economic differences strongly influence waste management in each country or region. The common direction has been set by the European Union with each member country implementing actions according their circumstances, with incentives and penalties in place to support compliance.

Implementing alternative waste disposal

National and regional government policy is a key influence on waste disposal. The policies in place for land use, taxing waste, contributing capital to build waste facilities, enabling public private partnerships, governing local authority procurement, and providing rebates for renewable energy generation, strongly influence what is being done.

Alternative waste treatment and disposal options

Several alternative treatment technologies for residual waste are commonly used to replace landfill and they effectively recover materials and/or energy. Waste to energy through mass burning is the only technology treating all wastes when they are created and where they are created.

Public and private ownership and management

Most waste facilities developed by a second level of government (local authority) have been designed to only dispose of waste generated by their community. Some provide additional capacity to accept waste from local businesses. Other waste facilities are being developed by energy companies using waste as a fuel to generate heat and/or electricity for their customers.

4. Discussion

4.1 Cultural and political environment

Key finding – Cultural and economic differences strongly influence waste management in each country or region.

The common direction has been set by the European Union with each member country implementing actions according their circumstances, with incentives and penalties in place to support compliance.

In the UK, even though each council was collecting similar amounts and types of waste from households, and collecting it in much the same ways, they had different ways of treating the waste and different ideas about the best way to dispose of it. It depended on the political outlook of the community and the council.

Every country visited in Europe had a different view on the appropriate amount of landfill or waste to energy and a different preparedness to pay. They are also collecting and disposing of similar waste streams to the UK. The waste produced by households and the way it is collected is similar across Europe but there are differences in the ways authorities choose to dispose of it.

The one common factor was the role of the European Union (EU) in setting waste policy and being highly influential in all member countries. The EU Waste Framework Directive (2008) is driving action to change waste disposal and the position of the EU Environment Policy to "help green the EU economy, protect nature, and safeguard the health and quality of life of people living in the EU."

The 2008 EU Waste Framework Directive required re-use and recycling of 50% of municipal waste by 2020. This is in addition to an earlier target set in the EU Landfill Directive to reduce biodegradable waste going to landfill to 35% of 1995 tonnages by 2020.

In December 2017 the EU issued a revision of its Waste Framework Directive that proposes an increase in the waste re-use and recycling target for municipal waste from 50% to be achieved by 2020 to 65% by 2030. It also proposes limiting disposal of municipal waste to landfill to a maximum of 10% by 2030.

Once the EU has issued a directive, each member country is left to determine the best way to comply with it. There are penalties applied for non-compliance through the Court of Justice of the EU, which can be fines of millions of Euros.

In response to the directive to re-use and recycle 50% of municipal waste, countries have introduced more comprehensive separation of waste in homes and businesses, and taxes on landfill. The landfill tax varies between countries. For example, in the UK the current landfill tax is $AUD156 per tonne and in Italy the landfill tax varies from region to region and ranges from $AUD18 to $AUD40 per tonne.

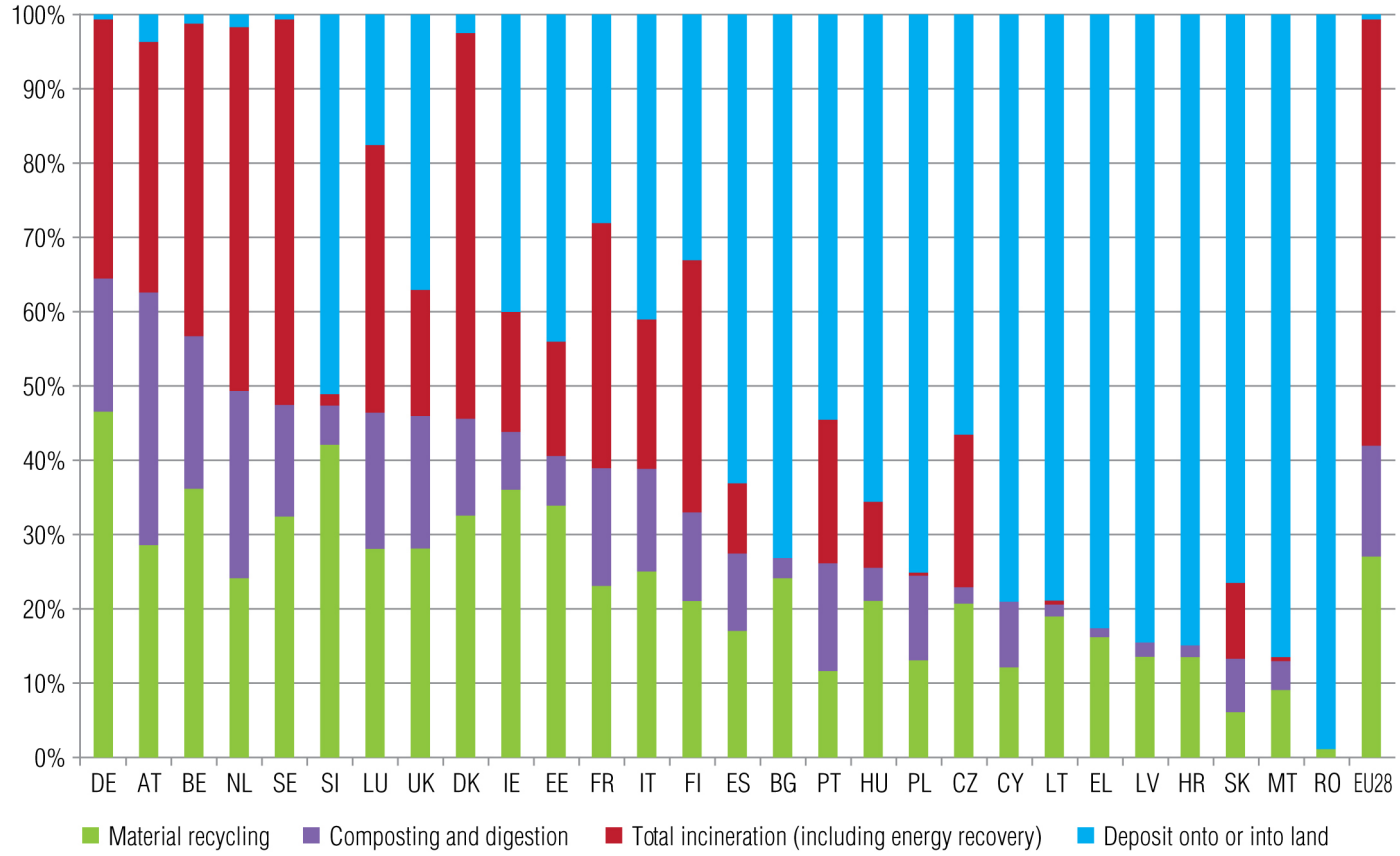
In France there is a sliding scale for landfill tax from $AUD64 per tonne for waste without treatment, $AUD53 in landfills meeting ISO 14001 requirements, $AUD38 if there is energy recovery from biogas, and $AUD26 if each landfill cell is constructed as a bioreactor.

In addition, waste cannot go to landfill from municipalities that do not have source separation.

Germany has no landfill tax but waste with an organic content greater than 3% cannot be sent to landfill.

Note: countries that have the lowest landfill, also have the highest use of incineration and have higher rates of recycling.

Figure 1. Waste treatment by EU countries in 2015.



The relative performance of EU counties in 2015 is shown above.

The education tour reinforced that Germany and Switzerland are leaders in material recycling, composting or digestion, and that thermal waste treatment has reduced waste to landfill to almost zero. In contrast, Spain, France, Italy and the UK are increasing re-use and recycling but are still reliant on landfill.

Australia is still sending almost all residual waste to landfill. It is the cheapest option but leaves a legacy for future generations to remediate the land used for landfill. By comparison, in the UK and Europe the need for each generation to deal with its own waste is recognised. There is community acceptance of energy recovery from waste and there has been significant investment in waste to energy facilities.

Germany	(DE)
United Kingdom	(UK)
Spain	(ES)
Italy	(IT)
France	(FR)

Relevance of the UK

The UK has been a recent point of reference for the Metropolitan Waste and Resource Recovery Group in determining a way forward with alternative waste treatment in Melbourne. The UK has a set of political and legislative drivers for waste management that are relevant to understanding how investments in alternative waste treatment have been made. This includes how responsibility for waste management is allocated between local governments under their Local Government Act.

First Tier Local Councils (County councils) are responsible for disposal of all residual waste (and achieving waste diversion targets), and dealing with any recyclable materials that a Tier 2 council surrenders to them. Second Tier Local Councils (District councils) are responsible for household kerbside collections of all waste streams - residual, organics/food, and recycling. Of the councils visited, North Yorkshire and Buckinghamshire are both County councils.

Tier 2 councils can take responsibility for disposal of recyclable materials and organics, which they usually only do only if there is value in it for them, or surrender these materials to their Tier 1 council. They have the obligation to meet recycling targets if they don't surrender their recyclable materials. They must surrender the residual waste to the Tier 1 council for disposal as it directs.

There are combined Tier 1/Tier 2 Councils (called City, or Metropolitan and/or Unitary councils), which have both Tier 1 and Tier 2 functions under their control. Of the councils visited, Milton Keynes is a Unitary council and Leeds is a Metropolitan council.

The Waste Education Tour, identified that Tier 1 and Tier 2 councils can have different objectives for the treatment of waste and they operate independently. Therefore, the integration of residual, recycling and organic waste management can be lacking and inconsistent on a regional basis. This has led to councils adopting different technologies to meet their needs.

Allocation of responsibility for waste disposal to Tier 1 councils has resulted in local solutions to waste produced by households and industry. Councils have made the investments necessary to replace landfill in their local area. This phase of landfill replacement in the UK is ending and today private entities are developing their own facilities and offering services to the remaining councils without facilities or to the commercial and trade waste producers whom effectively are still landfilling.

Energy companies are also building facilities that use waste as a fuel to generate electricity in small-scale facilities capable of helping meet peak demands for energy.

Advice from people involved in UK waste management is that the UK would not have invested billions of pounds in new disposal technologies as alternatives to landfill had the EU not directed it to do so, with the threat of penalties and fines for non-compliance.

4.2 Implementing alternative waste disposal

Key finding - National and regional government policy is a key influence on waste disposal. The policies in place for land use, taxing waste, contributing capital to build waste facilities, enabling public private partnerships, governing local authority procurement, and providing rebates for renewable energy generation, strongly influence what is being done.

Governments across Europe have made choices about how they will achieve the outcomes required by the EU directives on landfill and waste re-use and recycling. Long-term economic and social benefits have been identified by the EU as the rationale for the directives. Clearly there are short and medium-term impacts in changing the way wastes are managed.

Landfill is a well understood as a low-cost waste disposal option and local economies have developed around landfills. The collection and transport systems for waste are designed to take it as quick as possible to a nearby landfill. Land use planning accommodates landfilling through suitable zones and controls. Changing the system of waste disposal, especially to a higher cost disposal method, will have economic impacts.

This is well known in Victoria. For example, the Metropolitan Waste and Resource Recovery Group have calculated the economic cost of every dollar increase in a landfill tax. This cost will be borne by waste producers in the absence of effective schemes to recover the costs from product manufacturers or retailers. Households and businesses creating waste will need to pay more.

Some of these costs will be offset by the sale of resources recovered from waste. There is limited demand for many of these resources, especially when they are recovered from the residual waste stream and have been damaged through comingling with food wastes and broken glass. They have less value than source-separated materials which currently have less value than the cost of recovering them.

The significant capital cost to establish alternative waste treatment facilities has been addressed in various ways in countries visited, including full government funding or facilitation of public private partnership funding. Creating ways for councils to access large amounts of capital will be necessary for local government to continue participating in waste disposal.

The role of local government in Australia in collecting and disposing of household waste and simultaneously providing waste disposal for local businesses is mirrored in the UK. Councils have provided the 'municipal tip' at a local quarry hole. This has been a cost-effective way to deal with the result of extractive industries and there is a continuing connection in Melbourne between extractive industries, the creation of large holes, and landfilling.

Government subsidies or rebates for alternative treatment of waste are in place in the UK and Europe. This includes the landfill taxes previously discussed and rebates for renewable energy where waste is used to produce electricity. Electricity generators using waste as a fuel are also able to maximise the benefits of pricing incentives in the national grid.

In Switzerland the government contributes 50% of the capital for waste to energy plants from general federal taxes. In the UK a subsidy scheme was in place for up to 50% of the capital cost of alternative waste treatment facilities built under public finance initiatives i.e. public private partnerships.

Any alternatives to landfill in Australia will cost more and some options will be difficult to implement under current land use controls. Local Government will have difficulty funding large facilities because of the controls on procurement and public private partnerships, and limitations on access to capital from reserves or through debt.

The private sector will only fund alternative waste disposal facilities if they make a commercial return. This relies on government funding in one way or another when there is limited demand for the resources recovered from waste and the cost of landfill is low.

4.3 Alternative waste treatment and disposal options

Key finding - Several alternative treatment technologies for residual waste are commonly used to replace landfill and they effectively recover materials and/or energy. Waste to energy through mass burning is the only technology treating all wastes when they are created and where they are created.

Mass burning relies on a market for heat, or electricity generated from the heat, and a market or disposal option for residual ashes, and costs the same as landfill, if landfill costs and electricity prices are high enough. All other technologies produce recovered materials or fuel that rely on a market or government subsidy to pay for their recovery, e.g's, paper, plastic, liquid fertiliser, compost, fuel oils, biogas, and syngas.

It is important to stress that waste disposal is for residual waste – i.e. the waste remaining after separation at source.

Improved landfilling

Landfill is still an important way to dispose of waste in Europe, as can be seen in Figure 1. Some of it is residual waste from energy to waste treatments, some is the part of the residual waste stream remaining after material recovery and some is untreated waste.

Landfilling untreated waste creates greenhouse gases and leaves future generations with a legacy. For example, in Switzerland landfills are being excavated and the waste removed and burned in waste to energy facilities so that the land can be remediated. Costs incurred are 5 to 10 times more than the current disposal cost per tonne and much less than the cost of alternative treatment of the waste today.

Landfill management has been modernised at the landfills visited in Europe. Waste is compressed and baled before placement in the landfill. This ensures consistent levels of compaction and reduces the amount of moisture. If bales are wrapped it also reduces litter and the attraction of birds.

The cost to bale and wrap waste at the Montblanc landfill in France was around $A30 per tonne and it is a requirement of the planning approval as a way to minimise litter.

Some materials recovery is possible before baling and this was happening at the Idroedil landfill in Italy, where metals and organic material was being removed before baling. The removal of organic waste is a planning approval requirement.

Baling adds cost and is not necessary to optimise utilisation of the available landfill volume (conventional landfilling practice can achieve the same compaction) but it can reduce nuisance issues in the landfilling process.

These pictures show waste being baled and wrapped and the finished bales placed into landfill at the Montblanc landfill in France.

Materials recovery

All alternatives to landfill are more expensive and technically more difficult. Materials treatment (i.e. the recovery of materials of value from the residual waste stream) is possible before landfilling.

In the UK and Europe, the materials recovered from the residual waste stream have low value and limited demand. There are some exceptions, including recovered metals, Polyethylene Terephthalate (PET) and High Density Polyethylene (HDPE). Organic materials and plastics/paper are only recovered if there is a subsidy, local policy commitment or a mandated requirement. A similar situation exists in Australia.

Many residual waste material recovery facilities in the UK are not operating as intended, and some are limited to simply baling and wrapping the waste for export or transport to an energy from waste facility. The main reason is that the recycling market is tough and re-processors of recycled materials will not accept any contamination because the recovered materials become a cost to dispose of, rather than a source of income. The best way to achieve higher recycling is to improve the effectiveness of separation at source because it achieves a high density of recyclable materials at a low rate of contamination.

The facilities that do recover resources from the residual waste stream are highly industrial, and whether they recover metals, organics, glass, paper, plastics or energy, they are much more complicated to operate than a landfill.

There are specialist companies planning, financing, building and operating these waste facilities.

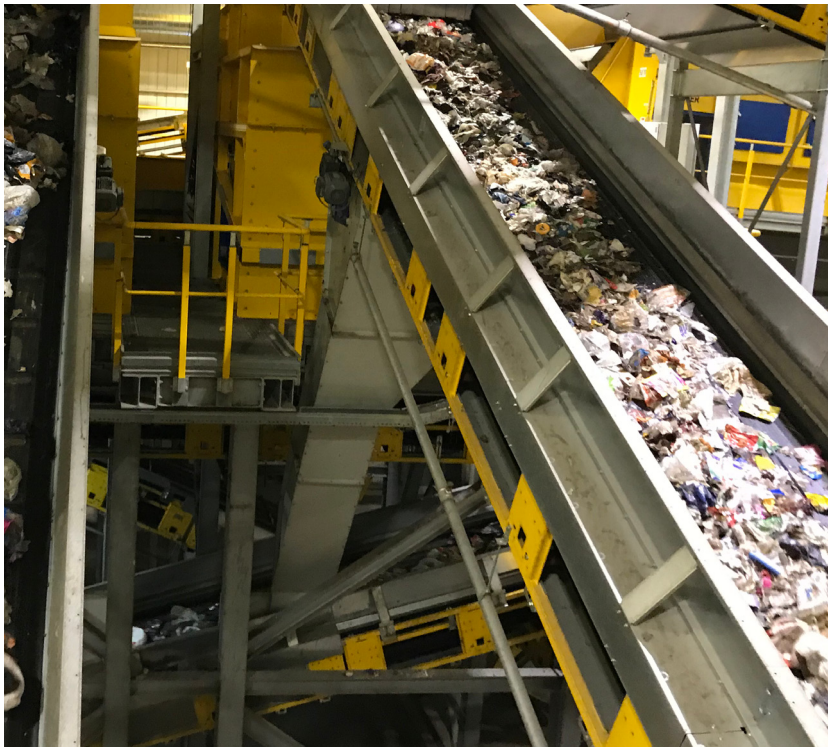
Separating food waste is important if waste is to be sent to a treatment plant because food coats conveyor belts (which requires more cleaning and maintenance), it affects ballistic and optical separation of plastics, and the material recovered are less valuable.

Metals are valuable but compost, paper and plastics recovered from residual waste are worth less than the cost of recovering them. Only landfill tax avoidance seems to justify doing it. Some facility operators said these materials were sold at a 'negative price' i.e. they were paying to dispose of them in a way that is cheaper than landfill. Materials in residual waste typically have more value for energy recovery through incineration with high-energy recovery.

Most of the facilities visited were designed for municipal solid waste and separation at source is the key to recovering the materials that have value greater than recovering their energy. The materials are cleaner, more readily processed, and more valuable. Every country visited had source separation. The absence of a market for most materials recovered from waste, except for energy, was apparent in every country.

The biggest market for materials recovered from the waste stream seems to be high calorific value plastic, textile and paper waste that can be used in cement kilns or waste to energy plants elsewhere in Europe. The UK exported 2.5 million tonnes of this waste, known as refuse derived fuel, to northern Europe in 2015.

These pictures show a typical materials treatment plant and bales of refuse derived fuel.



Alternative technologies

The most common alternative waste treatment technologies are aerobic composting (to create compost) or anaerobic digestion (to create biogas and compost) of organic wastes and waste to energy through mass burning (to create heat and electricity).

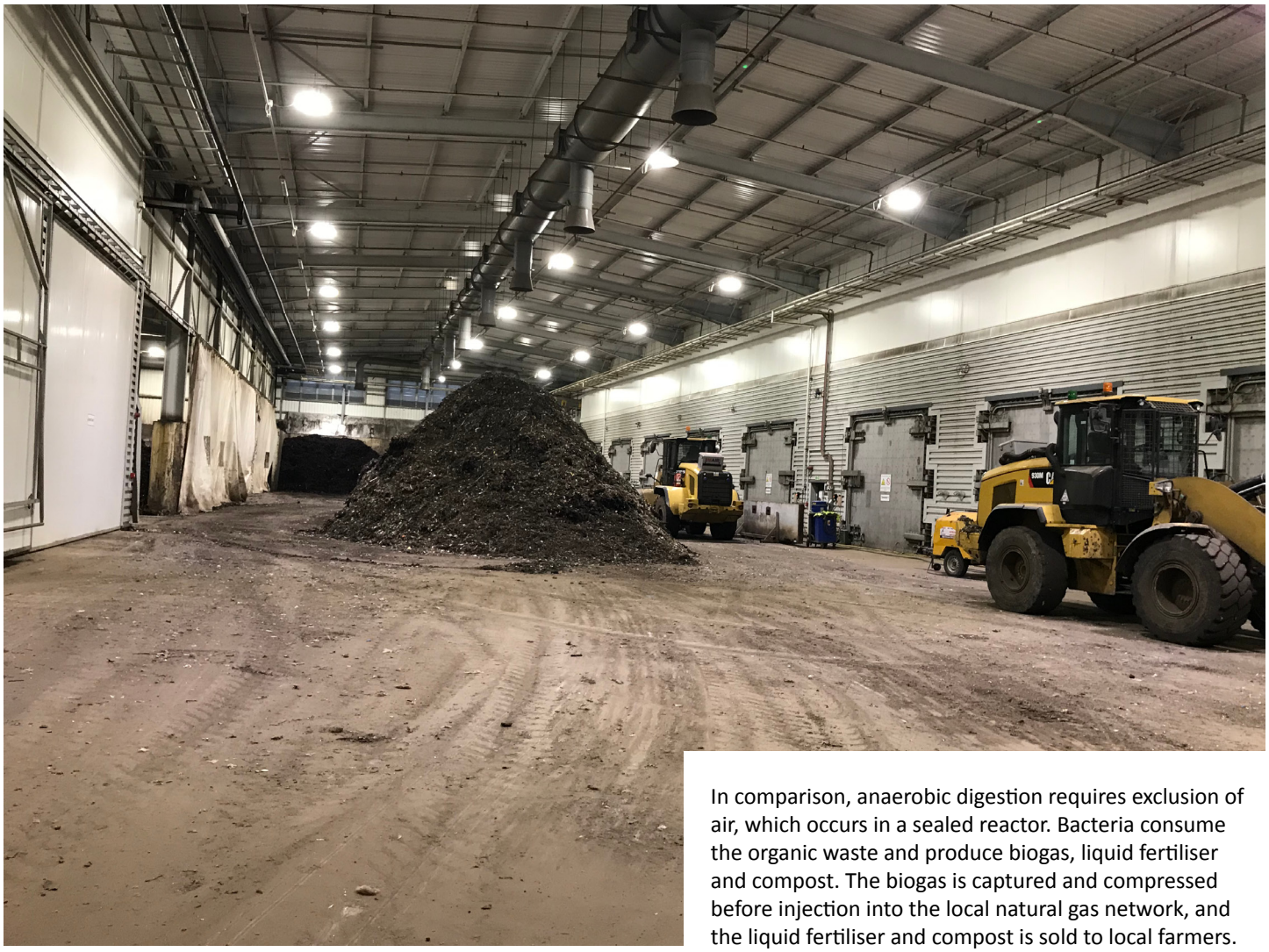
There are different waste to energy options. Milton Keynes in the UK burns waste through a two-stage process involving gasification to produce syngas, which is then burnt to generate electricity. Waste to fuel (creation of fuel oil) is a potential option but the only facility we visited that was doing it was Toledo, Spain where they were using flash pyrolysis of film plastics to produce fuel from waste in a small-scale trial plant.

Aerobic composting requires shredding, removal of over-size materials and windowing of the material in a shed where it is turned regularly to introduce air and create compost.

The Toledo composting facility cost $AUD15.5 million to build in 2012. It has the capacity to process 125,000 tonnes of organic waste to produce 25,000 tonnes of compost.

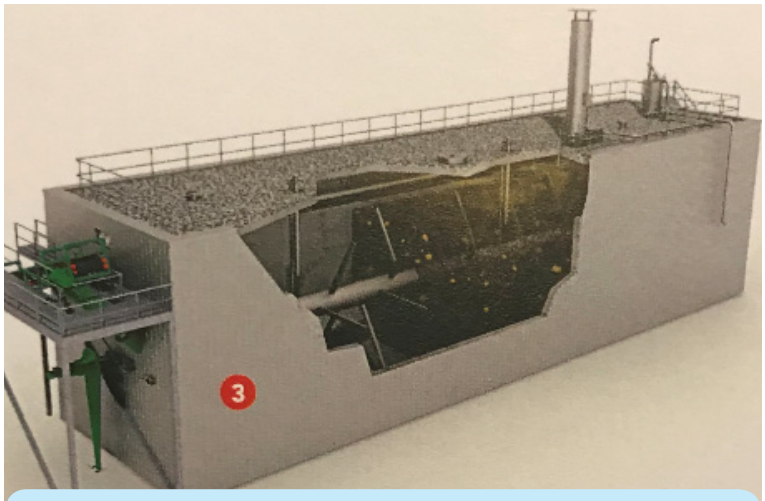
The picture below shows the aerobic composts happening in Toledo. The Toledo composting facility in Spain cost $AUD15.5 million to build in 2012. It has the capacity to process 125,000 tonnes of organic waste to produce 25,000 tonnes of compost.

It is also possible to do in-vessel composting. The photo below shows this happening at Milton Keynes, UK. Milton Keynes cost $AUD264 million in 2018 and has the capacity to treat 132,000 tonnes of waste, including 32,000 tonnes of organic waste recovered from residual waste.



In comparison, anaerobic digestion requires exclusion of air, which occurs in a sealed reactor. Bacteria consume the organic waste and produce biogas, liquid fertiliser and compost. The biogas is captured and compressed before injection into the local natural gas network, and the liquid fertiliser and compost is sold to local farmers.

The Winterthur anaerobic digestion plant cost $AUD18.6M to build in 2015. It has the capacity to treat 20,000 tonnes of source separated garden waste and food waste from homes and businesses to produce 4,000 tonnes of biogas.



This diagram shows the Winterthur reactor, Switzerland.

Mass burning is most commonly done in a staged combustion process on a moving grate furnace. There were many terms used to describe mass burning – staged combustion, thermal treatment, and modern incineration. The use of the term 'incineration' was avoided in all countries, except Switzerland and Germany, because it has negative connotations associated with destructors used in the past to dispose of waste through uncontrolled burning and without emissions treatment.

Waste doesn't need to be pre-treated for mass burning and municipal solid waste can be burned straight from collection.

At the Renergia plant, Switzerland the waste is accepted directly from the collectors without treatment. The diagram above is a section through the plant. It is worth noting that everything in the building between the red turbine on the left and the orange boilers on the right is gas treatment to ensure that emissions meet regulatory requirements.

The Renergia Waste to Energy Plant cost $AUD440 million to build in 2015. It has a capacity to burn 220,000 tonnes annually and produce 26MW of electricity and up to 92MW of heat. Waste is accepted into bunkers, burned to produce steam, which turns a turbine to generate electricity, and gases are treated chemically to meet emission standards.

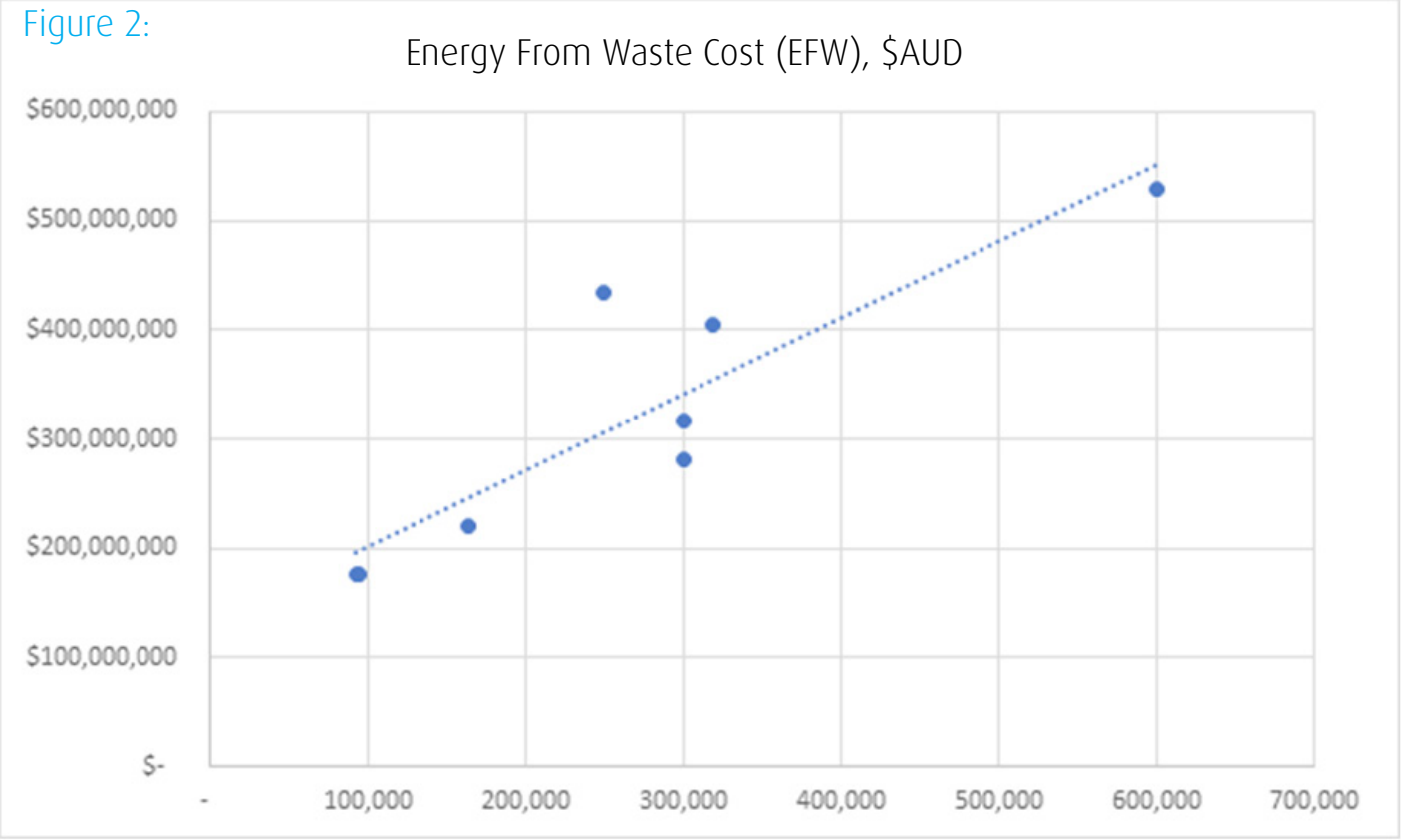
The Renergia plant burns waste in a multi-stage process like the previously described gasification and pyrolysis processes, with drying, pyrolysis, gasification, and burn-out. The moving grate technology is proven at large scale and has higher energy efficiency and lower emissions than other processes.

The plant also accepts material from landfill remediation (i.e. waste excavated from old landfills). This has started in Switzerland to minimise the long-term environmental impact of landfills to air, surface and ground water.

Waste to energy plants are large industrial buildings, as can be seen from the picture of the Renergia plant below.

The sheer size of the facilities is a consideration in locating them in urban areas. There are scale advantages in building large facilities. The graph below shows the comparison of capital costs and processing capacity of waste to energy plants visited.

Figure 2:



The capital cost per tonne of capacity to process waste varies considerably with technology and scale, this includes the investment in emissions cleaning.

The cost to transport waste to facilities located away from population centres needs to be considered. Waste is often treated close to where it is created and baled and transported to the final disposal point. This could be a landfill or taken to a waste to energy facility elsewhere.

This is evidenced by the UK exporting 2.5 million tonnes of refuse derived waste to Europe for burning as fuel in energy from waste facilities.

Waste to fuel

Waste to energy uses waste as a fuel to produce heat or electricity, which is consumed immediately in the location it is created. This requires the waste to energy plant to be located near connection points to the electricity grid and/or consumers of heat (e.g. the paper mill next to the Renergia plant).

Creating fuel from waste provides the flexibility to transport the fuel and use it elsewhere. It can also provide more versatile forms of energy, for example biogas can be cleaned and compressed for use in trucks and buses.

Making fuel from organic waste involves digestion in a reactor to create biogas, and making fuel from plastic waste involves gasification or pyrolysis to produce syngas or oil. This is also known as chemical recycling.

Gasification heats the waste plastic to produce 'synthesis gas' (syngas). This can then be used to produce fuel oils (diesel or petrol) or burned directly to generate electricity. Pyrolysis heats plastic waste in the absence of oxygen to produce an oil like crude oil.

At the sites visited there was limited waste to fuel production. The Winterthur anaerobic digestion plant produces biogas, which is injected into the natural gas grid but could be used for vehicles. 4,000 tonnes of biogas is produced from 20,000 tonnes of waste. At Milton Keynes, gasification is used to produce syngas, which is burned on site to generate electricity but could also be used off-site, as can the biogas from the composting facility.

At Toledo the waste to fuel plant uses 7,000 tonnes per year of waste to produce a fuel oil. It is currently a pilot but, depending on the success of the pilot, is capable of being scaled up to 28,000 tonnes per year.

This is an emerging technology for large scale treatment of plastic waste. It requires significant effort and investment to sort and clean the waste to provide more uniform feedstock than naturally occurs in a municipal waste stream.

4.4 Public and private ownership and management

Key finding – Most waste facilities developed by a second level of government (local authority) have been designed to only dispose of waste generated by their community. Some provide additional capacity to accept waste from local businesses. Other waste facilities are being developed by energy companies using waste as a fuel to generate heat and/or electricity for their customers.

The objective of the owner in developing the waste management facility is important.

County councils we visited were fulfilling their waste disposal responsibility in ways that they can afford and that meet their community's expectations. This has resulted in facilities sized to match municipal waste demand and designed for treatment of waste to achieve local sustainability goals. In some cases, these communities are paying a premium for small, local and specialised facilities.

In contrast, energy companies are specialists at generating electricity use their waste to energy plants, which are small compared to coal plants, to optimise scale efficiencies in electricity generation within the limitations of waste as a fuel. As a fuel, waste is a highly variable and has low calorific value compared to coal or gas.

The Milton Keynes Waste Recovery Park, UK is an example of this type of facility. The picture below shows their materials recovery (top), composting (middle right) and gasification and electricity generation (middle left). The building in the bottom is another council service.

The Ferrybridge Multifuel Energy-from-Waste Plant is an example of this type of facility. This picture shows the first of the two energy from waste plants that are being built alongside a decommissioned coal-fired power plant.

Waste to energy plants are small power stations making profits through the payment they receive to accept waste as fuel and by supplying power (especially in peak demand periods at premium prices). They contribute to base power but the main profits come in peaks. Energy companies understand the market for electricity and they take commercial and municipal waste and aim to maximise the energy recovery from waste at the lowest cost.

This doesn't mean that councils are not building large capacity municipal facilities that also cater for waste disposal for other councils and businesses. The Greatmoor Waste to Energy Facility in the UK is an example of this type of facility. 190,000 tonnes of its capacity is intended to be sold privately by the operator to generate revenue to offset Buckinghamshire County Council's waste disposal costs. Milton Keynes also has 60,000 tonnes of capacity that is being sold until such time as population growth generates additional municipal waste.

The significant costs and complexity in managing these facilities has led to councils working with partners to design, build and manage them. Some councils borrowed the funds to build facilities (e.g. Greatmoor, $320AUD million and Milton Keynes, $260AUD million). Other councils have entered into public private partnerships for facilities to be built and operated by third parties under long-term contracts (typically 25 years) that guarantee supply of waste and payment from the council (e.g. Allerton and Leeds).

Every council facility visited was operated by a specialist company. This is a change in business model from council waste disposal through landfill. Specialised skills are required to ensure that complex materials handling equipment, chemical treatment, furnaces and boilers, turbines and reactors are operated correctly. These companies included Veolia (waste company), FCC (waste company), Amey (services company), Axpo (green energy company), and Hitachi Zosen Inova (waste to energy supplier).

Many of these companies were also involved in putting together the deal to fund and build the facility.

In some cases, they have also provided funding through a public private partnership. Getting finance for alternatives to landfill is difficult because of risks associated with government procurement processes, grant funding requirements, obtaining planning approval, ongoing regulation, the waste composition and volume of waste, and forward sale prices of energy or recovered materials.

These risks are substantial and have prevented alternative waste treatment from becoming established in Australia. There are examples of proposed facilities that have not been able to manage or eliminate risks, so they have yet to be built. There are also examples of facilities that have been built and failed with significant financial loss.

The guaranteed supply of waste at a known revenue (i.e. councils commit to supply their municipal waste at an agreed price) over the life of the facility, and the forward purchase agreements for recovered materials or energy (i.e. electricity or heat) are both important in the financing of waste facilities. Banks want reassurance that the facility will generate returns.

Limited opportunities for the use of heat and low electricity prices can be a limitation on investment. Generating electricity from the heat generated from burning the waste is less efficient than using the heat directly. In northern Europe there is demand for district heating (i.e. providing heat to homes) and sometimes there are nearby industrial processes that can use heat (e.g. Renergia sells heat to the adjacent paper mill).

In Australia the demand for heat would be lower and highly seasonal for heating homes but there are industrial processes that require lots of heat (e.g. food processing) or cold (e.g. cold stores, data centres). The opportunity to co-locate these types of uses with a waste to energy facility exists at the Wyndham RDF with the development of the Werribee Junction Precinct Structure Plan (PSP).

5. Conclusion and recommendations

Waste treatment and disposal choices are being made by governments and communities within the context of regulation, economic impact, and markets for recovered resources. The value inherent in materials in the waste stream and the behaviour of waste producers in separating wastes are key considerations. Preparedness to pay for waste collection, treatment and disposal options, and who will pay, lies at the heart of choices being made about waste. There are significant costs and risks in moving away from landfilling to alternative treatment of waste.

If Australia is to become a modern nation in dealing with wastes generated in households and businesses it must stop transferring waste offshore for treatment or leaving it buried for future generations to treat. Action is required at the federal, state, and local level to develop a coordinated national waste management system.

5.1 Federal Government

- **National targets are needed for waste avoidance, recovery of materials or energy from waste, and to limit waste going to landfill.** In Europe this direction has been provided by the European Union.
- **Waste movement between states needs to be controlled.** The free movement of waste from one jurisdiction to another defeat state controls in place to encourage alternatives to landfilling.
- **Markets need to be created for recovered materials or to create incentives for them to be removed from waste to landfill or energy recovery.** It currently costs more to recover materials from residual waste than the materials are worth. If the amount of waste going to landfill is to be reduced, incentives must be provided for the diversion of materials. This could be through government subsidy (i.e. a suitable landfill tax) or by creating demand for recovered materials in public works.
- **Research is needed into waste to fuel technology and whether it is scalable to recover more value from plastics than is possible through energy recovery by burning.** Waste to fuel has the potential to see plastics re-used in a way that creates the greatest value from plastic waste. It is currently being done in small scale facilities and requires further research to determine its' feasibility at scale.

5.2 State Government

- **A consistent approach to waste separation at source across the state is needed to introduce efficiencies and coherence to household waste disposal.** Separation at source enables valuable materials to be recovered more easily for re-use or recycling, and it protects their value.
- **Planning approvals and the regulatory environment for waste facilities needs to be reviewed to recognise waste disposal as an essential service and remove risk from facility development.** The regulatory environment for waste management is open to delay and frustration based on philosophical differences about waste policy, not the merits of an application. Examples from the UK showed that objectors can delay facility development for many years and add millions of dollars in costs even when the national government policy position is clear.
- **Direct investment is needed in alternative waste treatment facilities and/or making it easier for councils to obtain funding from private sources.** Direct investment, either in state facilities or through councils, would immediately provide alternatives to landfill. This could include alternative waste treatment for source separated food and organic waste or energy from waste plants. In the UK the second level of government provides waste disposal facilities.
- **State support for the development of a market for recovered materials is also important, and where this is not possible, support for waste to energy is needed.** Recovering energy from waste is sometimes the most environmentally sustainable use of the waste and it can be done with less impact on human health and the environment than landfilling.

5.3 Local Government

- **Advocate to state and federal governments to get recognition that waste collection and disposal is an essential service, encourage best practice and to create a market for recovered materials and energy.** Councils play a critical role in collecting and disposing of municipal waste to keep homes, streets and cities healthy - this requires increased support from state and federal governments.
- **Facilitate joint investment by councils in waste separation, materials recovery and waste to energy to achieve waste management objectives.** Council can act collectively in regions to consistently separate waste at source, aggregate collected waste, share risks, contribute funding, and support investment in alternative waste treatment to reduce waste to landfill.
- **Organise for councillors and officers from the UK to visit and present at a seminar on alternative waste management by council.** The UK is more relevant to Australia than other countries visited. Several people met during the education tour commented that Australia seems to be at the same point that the UK was 20 years ago. The seminar could discuss what councils have done and why, how they have done it, and what the learnings have been.

5.4 Wyndham

Wyndham has an opportunity to lead by example. As a council and the owner and operator of a commercial waste disposal business, Wyndham has a unique insight into what is happening in waste management and what is possible. The waste education tour has consolidated that understanding.

Community waste disposal

- **Separate food waste at source and collect it in a combined garden and food waste service.** This is expensive to implement and will require effort to encourage the behaviour change necessary for it to be successful. It may need to be accompanied by investment in anaerobic digestion or aerobic composting facilities at the RDF.
- **Investigate the potential for joint investment in waste treatment and disposal with councils using the RDF for waste disposal to achieve waste and litter strategy objectives.** This would take advantage of the RDF permit, licences, approvals and location to underwrite smaller scale investment in waste treatment that supports achievement of outcomes in Wyndham's Waste and Litter Strategy while other levels of government determine their policy response to the waste problem in Australia and Melbourne.

  This could include cooperative action with inner city councils (e.g. Melbourne and Port Phillip), and Geelong, and western region councils.

Commercial waste disposal

- **Set up the RDF as a suitably zoned, permitted, licensed, and approved site for a range of waste management activities.** This will prepare the RDF to support creation of jobs in a circular economy. This will involve close engagement with the development of the Werribee Junction PSP to encourage the co-location of high heat, cold or energy consuming activities, such as data centres, cold stores, and food processing.
- **Improve landfilling practice by investigating removal of the organic fraction of residual waste for anaerobic digestion and the potential to compress, bale and wrap waste before placement into the landfill.** Removing the organic fraction will reduce methane and leachate production, which reduces risks associated with landfilling. A bale landfill is more expensive to operate but it can reduce nuisance impacts from landfill operations, such as noise, litter, and birds. It may also facilitate later recovery of waste.

  This is an interim measure as landfilling is going to be the main way that municipal waste will be managed for disposal in Melbourne for the next 10 to 20 years, even with investment in waste to energy. It makes waste more easily recoverable for use as fuel in a future waste to energy facility.
- **Prepare to invest in materials recovery from residual waste if a market develops for recovered materials or landfill taxes make it cost-effective.** Materials recovery is expensive and, except for a few materials, will cost more than the value of the recovered materials, especially from a residual waste stream. It will reduce waste going to landfill and is worth considering if the landfill levy increases or demand increases and recovery will earn more than the cost of recovery.
- **Find suitable partners to work on developing the RDF as a location for waste to energy using proven technology.** Every Alternative Waste Technology (AWT) 'industrialises' waste disposal (in comparison with landfilling) and requires investment in, and operation of, sorting plants, reactors, boilers, turbines, or refineries. The RDF is a suitable location to support the large investments needed and has significant advantages as a working landfill. The amount of investment required and the capability needed to operate AWT is best provided by a partner or partners.

6. Waste education tour follow-up activities

A blog was created on Wyndham's website to provide updates throughout the education tour and as a reference for the details of each site visited.

A detailed Council report will be prepared that describes the key findings and the opportunities for Wyndham.

Presentations will be made to the following groups:

- Metropolitan Waste and Resource Recovery Group Forum
- CEOs of Western Region councils
- Western Region Infrastructure Directors
- Interface Infrastructure and Planning Directors

Briefings to Federal and State Politicians:

- Federal Minister for Environment and Energy, Josh Frydenberg
- State Minister for Energy, Environment & Climate Change, Lily D'Ambrosio
- State Shadow Minister for Environment, Nicholas Wakeling
- Member for Werribee, Treasurer for Victoria, Tim Pallas

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Attachment 1. Working Schedule

From	To	Session
1.00pm	3.00pm	**Leeds Recycling and Waste Recovery Centre, 1 May 2018** Briefing by Veolia and Leeds City Council on the development and operation of the facility, followed by a site tour.
10.00am	4.00pm	**Allerton Waste Recovery Park, 2 May 2018** Briefing by North Yorkshire County Council and Amey on the planning, funding, development and operation of the facility, followed by a site tour.
10.00am	2.00pm	**Milton Keynes Waste Recovery Facility, 3 May 2018** Briefing by Milton Keynes Council and Amey on the planning, funding, development and operation of the facility, followed by a site tour.
3.00pm	6.00pm	**Greatmoor Waste to Energy Facility, 3 May 2018** Briefing by Buckinghamshire County Council and FCC Environment on the planning, funding, development and operation of the facility, followed by a site tour.
10.00am	5.00pm	**Ferrybridge Waste to Energy Facilities 4 May 2018** Briefing by Hitachi Zosen Inova (HZI) on design and construction of MF2 plant (under construction) followed by site tour, then briefing by HZI and Multifuel on the operation of the MF1 plant followed by a site tour.
9.00am	12.00	**Ferrovial Centre of Excellence for the Environment 6 May 2018** Briefing with senior staff from the Centre of Excellence on innovations in waste treatment technology.
1.00pm	4.00pm	**Ecoparque de Toledo 6 May 2018**Briefing by Ferrovial and Gesmat (joint venture between Ferrovial and the Toledo local authority) on operation of the facility followed by a site tour.
9.00am	11.00am	**Cross Wrap, 9 May 2018** Meeting with Cross Wrap (Finnish bale wrapping supplier) to discuss their technology and its application in a bale landfill.
12.00pm	4.00pm	**Montblanc Landfill, 9 May 2018** Briefing with Landfill Manager Vincent Lambert to discuss the operation of the landfill, followed by a site tour.
10.00am	2.00pm	**Idroedil Waste Management Landfill, 10 May 2018** Briefing and site visit to materials treatment plant, landfill, and composting facility.
3.00pm	4.00pm	**Mondial GIS, 10 May 2018** Meeting with Davide Amieri, principal with Mondial GIS, to discuss waste to fuel technology and bioreactor landfill development.
9.00am	3.00pm	**Macpresse Europa, 11 May 2018** Briefing with design engineers and site tour of bale press manufacturing plant.
9.00am	6.00pm	**IFAT Trade Fair, 14 May 2018** Attended trade fair and met with suppliers of services and technology.
9.00am	6.00pm	**IFAT Trade Fair, 15 May 2018** Attended trade fair and met with suppliers of services and technology.
9.00am	2.00pm	**Augsburg Anaerobic and Waste to Energy Facility, 16 May 2018** Briefing on the operation of the facility, followed by a site tour.
4.00pm	6.00pm	**IFAT Trade Fair, 16 May 2018** Attended trade fair and met with suppliers of services and technology**.**
10.00am	12.00am	**Kompogas Anaerobic Digestion Plant, 17 May 2018** Briefing with HZI on the design and operation of the facility, followed by a site tour.
1.00pm	2.30pm	**Hitachi Zosen Inova, 17 May 2018** Briefing with a Director of HZI to discuss new technology and facility design and delivery.
3.00pm	5.00pm	**Renergia Waste to Energy Plant, 17 May 2018** Briefing with the Plant Manager on the design and operation of the plant, followed by a site tour.

Attachment 2. Wyndham City Delegation

Name	Position	Organisation
Cr Peter Maynard	Wyndham City Council	Mayor
Stephen Thorpe	Wyndham City Council	Director, City Operations
Simon Clay	Wyndham City Council	Manager, Waste Management and Disposal

Attachment 3. List of Organisations

Name	Position	Organisation
Gush Bambhrah	Recycling Advisor	Leeds City Council
Helen Johnson	Education Officer	Veolia
Cllr Andrew Lee	Executive Member – responsible for waste management	North Yorkshire County Council
Ian Fielding	Assistant Director - Transport, Waste and Countryside Services	North Yorkshire County Council
Mark James	Head of Construction	Amey
Paco Hevia	Technical Director	Amey
Nicholas Hannon	Head of Environment and Waste	Milton Keynes Council
David Proctor	Waste Manager	Milton Keynes Council
Eddie Simpson	Facility Manager, Milton Keynes	Amey
Cllr Bill Chapple OBE	Cabinet Member for Planning and Environment,	Buckinghamshire County Council
Cllr Clive Hariss	Deputy to Cabinet Member for Planning and Environment	Buckinghamshire County Council
Roger Seed	Waste Contracts Team Leader	Buckinghamshire County Council
Jez Elkin	Waste Awareness and Education Manager	FCC Environment
Colin Drew	Plant Manager, Ferrybridge	Multifuel
Richard Belfield	Director Project Development	Hitachi Zosen Inova, UK
Vicente Galvan	Director, Centre of Excellence for Environment	Ferrovial
Antonio Beaus	Director of Operations	Ferrovial
Ruben Munoz	Facility Manager, Toledo	Gesmat
Miguel Ruiz Barcia	Head of the Technical Office, Centre of Excellence	Ferrovial
Heikki Jyrkinen	Sales Manager	Cross Wrap, Finland
Vincent Lambert	Landfill Manager	Coved Environment
Martino di Nola	Area Export Manager	Macpresse Europa
Davide Amieri	Principal	Mondial GIS
Giuliano Scotuzzi	Export Sales Manager	Macpresse Europa
Dr Stafania Barbano	Export Sales Manager	Coparm, Italy
Herman Sioen	General Manager	CNTY Europe
Danilo Broglia Montani	Project Development Manager	Sorain Cecchini Tecno, Italy
Marc Stammbach	Managing Director	Hitachi Zosen Inova, Australia
Andres Kronenberg	Vice President of Marketing and Sales	Hitachi Zosen Inova, Switzerland
Rudi Kummer	Plant Manager	Renergia Zentralschweiz, Switzerland

Wyndham Waste Education Tour - May 2018

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