

Report to the Minister for Energy, Environment and Climate Change

Waste to energy consultation and
case study for Melbourne's West



Cesar Melhem MP

Western Metropolitan Region
Parliament Of Victoria



REPORT TO THE MINISTER FOR ENERGY, ENVIRONMENT AND CLIMATE CHANGE

WASTE TO ENERGY CONSULTATION AND CASE STUDY FOR MELBOURNE'S WEST

Final Report

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FORWARD

Communities in Melbourne's West continue to express their concerns about the impacts of large residual waste landfills at Ravenhall and Werribee. Collectively, these landfills receive more than half of all waste disposed to landfill in metropolitan Melbourne, much of which is transported from across the city into the Western Suburbs. The disposal of waste to landfill creates significant amenity issues for residents living near these sites, including those in the large residential developments around Caroline Springs, Deer Park, Derrimut and Wyndham Vale. The decomposition of organic waste, mostly food waste from commercial businesses and households, creates odour that can force residents indoors and impact their quality of life.

As the Member for Western Metropolitan Region, I am compelled to look for alternative ways for Melbourne to manage its waste, where resource use is maximised and the impact on communities is minimised. Many other developed nations have moved away from landfill in recent years, instead opting to generate energy from residual waste in highly controlled facilities. Waste to energy plants have smaller footprints, fewer amenity impacts and offer new opportunities for energy generation than landfills. They can create new training, employment and economic development opportunities for Victoria, and ultimately improve the way we manage our resources.

Over the past three months, I have been undertaking consultation with the waste and resource recovery industry, local government authorities and the community on the opportunities for waste to energy in Melbourne's West. I am pleased to present this report, which includes the findings of the consultation program, as well as a case study on what waste to energy might look like for our community.

The results of the consultation can be summarised as follows:

- There is broad support for waste to energy as an alternative to landfill in Melbourne. This is shared across industry, local government and community stakeholders. However, the community has concerns about how the technology works, what risks it might lead to and how the hazardous outputs such as fly ash and filter cake will be managed.
- Community and local government consultees have made it clear that the Victorian Government should be doing considerably more to address upstream issues of waste generation, through improved education, reuse and increased recycling. At almost all consultations this was listed as critically important, with residual waste treatment being referred to as "the last resort".
- Residents of Melbourne's West have made it clear that the burden and impacts of waste management should be shared more fairly across the community. Having "mega" waste sites (either landfills or otherwise) is not appropriate and the concept of environmental justice, which calls for shared responsibility and intergenerational equity, should be embraced. Waste to energy facilities should therefore be located across Melbourne and regional Victoria, servicing local and regional communities.
- The industry has suggested an ideal model for large-scale waste to energy, which would involve facilities at a scale of around 300,000 tonnes per annum, of which 80% of the waste would need to be contracted for at least 20 years. This highlights the important role of MWRRG in securing the required feedstock.



- Industry and local government both highlighted the cost disparity between waste to energy and landfill (which is in the order of \$80 - \$100 per tonne) as a critical barrier, however at least for municipal waste treatment this could be overcome through collaborative tendering of local government waste. Interestingly, barriers associated with planning approvals, works approvals and licensing were highlighted as being the most challenging issues, suggesting that EPA Victoria would need to play a far more proactive role in supporting projects than it currently does.
- Industry consultation also suggested that the Victorian Government should remain technology agnostic, and instead focus on setting clear objectives and goals that the market could look to achieve with a broad range of technology solutions. It was suggested that the absence of an overarching waste policy does not give the sector confidence in the government's direction.

There is clearly an appetite to move away from landfill and toward alternative treatments for residual waste. I hope that the findings of this consultation program, as well as the work being undertaken by the Department on the waste to energy discussion paper, provide a strong case for moving forward.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Cesar Melhem', with a stylized, flowing script.

Cesar Melhem

Member of the Legislative Council
Western Metropolitan Reg

EXECUTIVE SUMMARY

The Department of Environment, Land, Water and Planning (DELWP) has appointed Reincarnate Pty Ltd (Reincarnate) to work closely with Cesar Melhem MP, Member for the Western Metropolitan Region, to undertake targeted consultation on the introduction of waste to energy technology as an alternative to landfill in Melbourne's West. The project has arisen as a result of community concern related to the approved expansion of large residual waste landfills at Ravenhall (operated by Cleanaway, formally Boral) and Werribee (operated by Wyndham City Council). This report has been prepared on behalf of Mr Melhem for the Minister for Energy, Environment and Climate Change.

Working closely with Mr Melhem, the consultation process has included:

- One on one consultation with major waste and resource recovery industry participants, including Cleanaway, Veolia, Visy and Suez.
- A local government workshop for senior level representatives (Mayor, Councillor and CEO/Director level attendees) from Hume City Council, Wyndham City Council, City of Melton, Maribyrnong City Council, Hobsons Bay City Council, Brimbank City Council and Moonee Valley City Council.
- Two open community consultation sessions at Caroline Springs and Hoppers Crossing.

The project has run in parallel, but separately to, the open consultation period for the recently released Victorian Government discussion paper *Turning Waste into Energy*, which specifically seeks feedback from government, business and the community on the role of waste to energy in managing waste in Melbourne.

The project report, which has been prepared for the Minister for Environment, Hon Lily D'Ambrosio, is presented in three parts:

Part 1 – Background to the issue and waste to energy technology

Part 2 – Overview of the consultation program and its findings, broken down across industry, local government and community consultees

Part 3 – A standalone, theoretical case study that presents a version of how waste to energy might look were it to be established in Melbourne's West.

The findings of the project can be summarised as follows:

Summary of findings

- *There is broad support for waste to energy as an alternative to landfill in Melbourne. This is shared across industry, local government and community stakeholders. However, the community in particular has concerns about how the technology works, what risks it might lead to and how the hazardous outputs such as fly ash and filter cake will be managed.*
- *The industry has suggested an ideal model for large-scale waste to energy, which would involve facilities at a scale of around 300,000 tonnes per annum, of which 80% of the waste would need to be contracted for at least 20 years. This highlights the important role of MWRRG in securing the required feedstock.*
- *Industry and local government both highlighted the cost disparity between waste to energy and landfill (which is in the order of \$80 - \$100 per tonne) as a critical barrier, however at least for municipal waste treatment this could be overcome through collaborative tendering of local government waste. Interestingly, barriers associated with planning approvals, works approvals and licensing were*

highlighted as being the most challenging issues, suggesting that EPA Victoria would need to play a far more proactive role in supporting projects than it currently does.

- *Industry consultation also suggested that the Victorian Government should remain technology agnostic, and instead focus on setting clear objectives and goals that the market could look to achieve with a broad range of technology solutions. It was suggested that the absence of an overarching waste policy does not give the sector confidence in the government's direction.*
- *Community and local government consultees have made it clear that the Victorian Government should be doing considerably more to address upstream issues of waste generation, through improved education, reuse and increased recycling. At almost all consultations this was listed as critically important, with residual waste treatment being referred to as "the last resort".*
- *Residents of Melbourne's West have made it clear that the burden and impacts of waste management should be shared more fairly across the community. Having "mega" waste sites (either landfills or otherwise) is not appropriate and the concept of environmental justice, which calls for shared responsibility and intergenerational equity, should be embraced. Waste to energy facilities should therefore be located across Melbourne and regional Victoria, servicing local and regional communities.*
- *The disposal of organic waste to landfill is the highest priority, given it is the largest contributor to amenity issues such as odour. Steps to remove organic waste from landfill disposal will reduce community impacts and facilitate development of alternative waste treatments such as waste to energy in Victoria.*

1 INTRODUCTION

The Department of Environment, Land, Water and Planning (DELWP) is responsible for the protection and preservation of Victoria's native landscape. Within this remit is the management of solid waste, where DELWP works with its partner agencies Sustainability Victoria (SV) and Environment Protection Authority Victoria (EPA Victoria) to ensure that the environmental risks associated with waste are minimised and the value of recovered resources is maximised.

DELWP is currently working to develop new policy settings in order to facilitate investment in new waste and resource recovery infrastructure. In particular, DELWP is exploring the opportunities, risks and barriers to waste to energy development in Victoria. A discussion paper on this topic was released in October 2017.

Parallel to the development of the discussion paper, the recent EPA approval for the expansion of the Melbourne Regional Landfill (MRL) at Ravenhall has elevated the communities interest in waste management infrastructure. Negative publicity generated by the landfill, in addition to a spate of recent fires at recycling depots and media coverage of the industry more broadly, pose a significant risk to any discussion related to new waste management infrastructure.

The Minister for Energy, Environment and Climate Change, Hon Lily D'Ambrosio recognises that there is ongoing community concern with regard to the expansion of MRL and that new, long-term alternatives to landfill are required. Reincarnate has been appointed to work with the Member for the Western Metropolitan Region, Mr Cesar Melhem, and DELWP to undertake targeted consultation with industry, local government and the community in facilitating this consultation and providing a brief summary report of the key findings.

This report is structured across three parts:

Part 1 – Background to the issue and waste to energy technology (note we have kept this very brief given significant background is provided in the current discussion paper)

Part 2 – Findings from the consultation program

Part 3 – A waste to energy case study for Melbourne's West

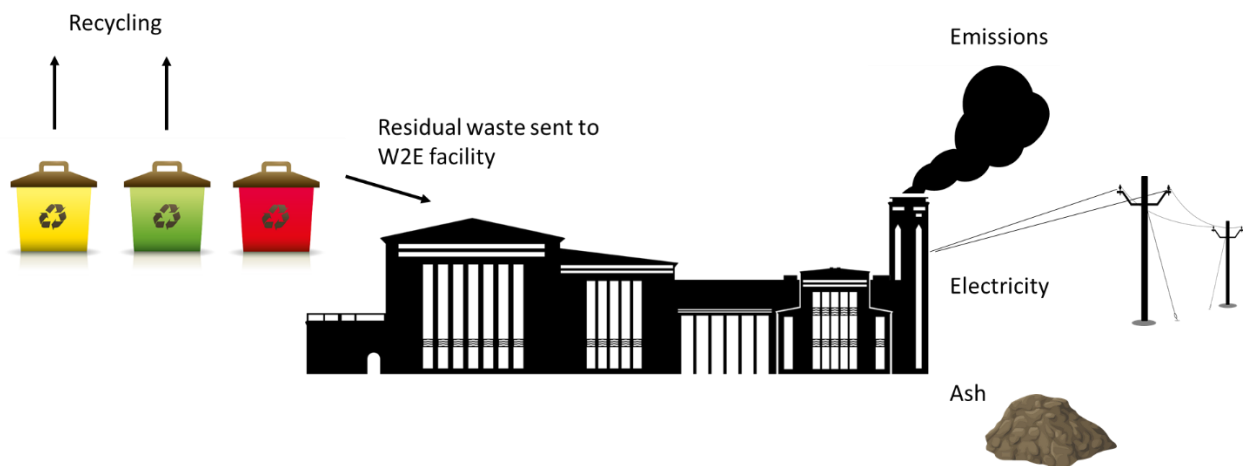
It is important to note that whilst waste to energy encompasses a broad range of technologies that can operate at very different scales (from small boilers processing 5,000 tonnes of timber waste, to "mega" facilities processing over 1,000,000 tonnes of commercial and household waste), the overwhelming majority of consultation for this project assumed waste to energy facilities of a scale that could process municipal waste, which would be in the order of 250,000 – 400,000 tonnes of waste per annum. This should be considered when reading the consultation findings.

PART 1 – BACKGROUND

2 WASTE TO ENERGY OVERVIEW

Waste to energy (often referred to as waste to energy) refers to the conversion of “residual” waste into energy (power, heat and/or steam) using a thermal process such as incineration, gasification or pyrolysis – which essentially means burning waste within different oxygen environments. There is a raft of technical information that relates to waste to energy, from the engineering requirements through to the types of chemical and physical reactions that define outputs and emissions. Detailed technical commentary is not appropriate for this report, which seeks to provide an overview of the technology only. A simplified diagram is provided in Figure 1 below.

Figure 1 Simplified overview of waste to energy infrastructure



Essentially, waste to energy involves the incineration of residual waste in a controlled facility, the outputs being emissions, electricity, heat and ash. In addition, a small amount of hazardous waste is generated through the emissions stack, where filters are used to remove heavy metals and dioxides (this waste is referred to as “filter cake”).

The definition of **residual waste** is important in the consideration of waste to energy, and in general this means waste that has been through some form of pre-sorting (materials recycling facility, reprocessor etc) to recover as many materials as technically and economically possible, and that would otherwise be sent to landfill.

Effectively this means that waste to energy in Victoria is **only** an appropriate solution for the left over waste after as much recycling and recovery as practicable has been achieved.

There are many types and scales of waste to energy facilities, ranging from mass-burn incinerators capable of processing more than a million tonnes of waste per annum, to small, bespoke units that can fit into a shipping container. The deployment of waste to energy, and indeed any alternative waste technology, therefore needs to consider scale, waste type and the desired outcomes of government and the community.

The following case studies present an overview of waste to energy scales and types.

The Beaufort Hospital, Victoria uses a waste timber fired boiler to provide heating across the hospital site. The unit is constructed within a shipping container, using locally sourced timber residues for feedstock. The installation of this small waste to energy unit offsets some \$36,000 in LPG costs annually.

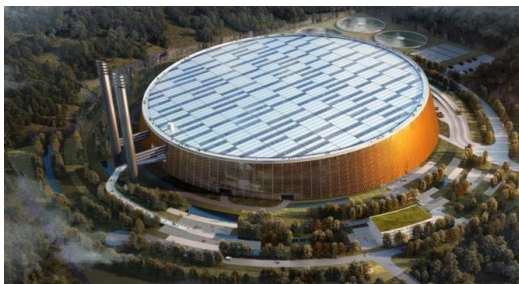


Sheffield Energy Recovery Facility

A medium-sized waste to energy facility processing around 225,000 tonnes of household waste per annum, located in a highly populated area in close proximity to residential development. The site combines electricity generation with district heating to more than 140 local buildings (including schools and hospitals).

Riverside Resource Recovery Facility

At a larger scale, the Riverside RRF processes around 600,000 tonnes of commercial and household waste providing electricity to some 78,000 households and 15,000 flats. The plant is fed by waste arriving on barges down the Thames, reducing traffic within the City of London.



Shenzhen, China

Currently under construction, the waste to energy facility being developed in Shenzhen will be the world's largest, capable of processing 1.8 million tonnes per annum. To put this in perspective, a single facility of this size could utilise 50% of all waste going to landfill in Victoria.

2.1 Advantages of waste to energy

Waste to energy should be considered as part of a holistic set of interventions designed at reducing our dependence on landfill. Most western countries, including Australia, are recognising that burying waste in landfill constitutes a poor outcome for resources. Increasingly, recycling of commodities such as paper, cardboard, steel, glass and some forms of plastic is reducing our reliance on landfill.

However, the recycling industry depends on revenue from the commodities it produces. As such, the sector cannot recover and recycle all types of materials as many do not have a market that is strong enough to cover the cost of

recovering and recycling that material. The waste streams from which it is not feasible to extract more value are known as “residual waste”.

At present, the majority of residual waste in Australia is sent directly to landfill. There are some benefits that can be generated from this, with well-managed landfills capable of capturing more than 90% of the methane they create for generation of alternative energy. However, landfills consume valuable land, require significant buffers and represent an environmental and social risk through odour, generation of contaminated leachate and vermin.

For these reasons, many countries have chosen to use waste to energy technology to manage residual waste. This has been driven by community attitude and strong policy settings, such as the EU Landfill Directive which has supported a considerable move away from landfill across Europe. The benefits of waste to energy infrastructure include:

- Significant reduction in waste to landfill (in the order of 75% or greater)
- Development of new energy generation, the organic portion of which may be classed as renewable energy
- Significant reduction in required landfill airspace
- Facilities require a much smaller footprint than landfills
- Greater energy capture than landfills which only generate energy from the organic fraction

In addition, waste to energy provides secondary benefits through new job creation, new skills and training opportunities and infrastructure investment.

However, it should be noted that waste to energy is not the only way to reduce the dependence on landfill. Waste to energy belongs to a category of infrastructure referred to as advanced resource recovery technology (ARRT), which also includes:

- Anaerobic digestion
- Mechanical-biological treatment
- In-vessel composting
- Autoclaving

The deployment of these technologies depends on the outcomes being sought, and experiences overseas suggest that government at all levels should focus on defining the desired outcomes rather than choosing technology winners.

2.2 Issues and concerns

Whilst waste to energy is an attractive way of delivering greater landfill diversion, there are a number of critical issues that can block the way for new infrastructure development. The main issues are explored below:

Capital and operational cost

Under the current policy settings, waste to energy infrastructure is significantly more expensive to develop and to operate than a landfill. Capex requirements for a 300,000 tonne facility are likely to be in the order of \$200 million with operational expenditure being in the order of \$100/tonne (\$30 million per annum). Industry estimates suggest a minimum gate fee of around \$200/tonne for a medium to large scale waste to energy facility, which is roughly double the gate fee of landfill in Melbourne.

<i>Contract length</i>	In order for the market to invest in such high costs, there needs to be surety of feedstock. This is generally achieved using municipal waste from councils as the baseline feedstock, entering into contracts with multiple councils over 15 – 25 years. Opponents of waste to energy claim that locking up waste over such long time-frames essentially blocks new recycling technologies from emerging.
<i>Lack of recycling</i>	In any system where there are multiple technologies operating there is likely to be some competition for inputs. Mass-burn incinerators require large volumes of material with high calorific value ¹ to remain profitable. There are some concerns that the development of these facilities may undercut legitimate recycling ventures and restrict the amount of material being genuinely recycled. The definition of “residual waste” and how this is managed within the policy framework can be an effective tool in managing this risk.
<i>Air emissions</i>	The incineration of waste materials, either by direct combustion or through gasification or pyrolysis, results in the creation of air emissions which contain heavy metals and toxic gases such as sulphur oxides (SOx) and nitrogen oxides (NOx), as well as particulate matter (related to air quality and asthma) and carbon dioxide (CO ₂). However, strict standards on air emissions means that modern waste to energy facilities have sophisticated air “scrubbing” equipment which cleans the air of dangerous and toxic elements, leaving mostly CO ₂ as an output.
<i>Hazardous waste from incineration</i>	Waste to energy facilities do not completely remove the need for landfills. Waste to energy facilities generate ash which amounts to around 15% - 25% by weight of the material consumed ² . They also generate small volumes of highly toxic filter cake, which is the residue left on filters during the air scrubbing process. Some of this material requires specialist disposal in a regulated hazardous waste landfill.
<i>Ongoing amenity issues</i>	If managed correctly, waste to energy should significantly reduce the incidence of odour from residual waste as material is dumped inside a large hall which is under constant negative air pressure. However, other amenity impacts associated with waste transport (i.e. truck movements) will not be materially reduced and could actually increase as the scale of waste to energy tends to be smaller than large landfills, thus more facilities may be needed overall.

2.3 The current state of waste to energy in Victoria

At present there are a limited number of waste to energy facilities in Australia; none of which are processing residual household waste or are operating at considerable scale. The market in Australia is currently restricted to small scale facilities such as industrial boilers and anaerobic digestion of biosolids.

The largest current example in Australia is likely to be the joint ResourceCo – SUEZ facility in Wingfield, SA, which converts dry commercial and industrial waste into a process engineered fuel (PEF) which is then co-fired in the Adelaide-Brighton cement kiln.

¹ Calorific value (CV) refers to the amount of energy in a fuel. The higher the CV, the more energy that can be produced during incineration.

² United States EPA. ‘Energy Recovery from the Combustion of Municipal Solid Waste (MSW)’. Accessed 11 November 2017

In Victoria, there are a number of small – medium scale waste to energy facilities, including:

- Yarra Valley Water, Aurora – Medium scale anaerobic digestion facility converting 30,000 tonnes of commercial food waste into energy annually. The site is co-located with an existing sewage treatment facility which is an ideal siting location. The facility cost some \$27 million to construct.
- VISY Coolaroo – A dedicated waste to energy facility which utilises residues from paper and box manufacturing to generate onsite heat and electricity for the VISY Coolaroo plant.
- Beaufort Hospital – Small scale waste timber boiler providing heat via hydronic heating throughout the hospital.
- City Circle Demolition, Brooklyn – Small scale timber gasification unit providing power to onsite infrastructure such as concrete crushing plant. Project received funding from Victorian Government through the Driving Investment in New Recycling Fund.
- Clean Energy Group, Dandenong – Medium scale pyrolysis facility designed to process waste tyres. Facility has been constructed for more than 18 months but is still not fully operational.
- Waranga Green Energy – Facility currently under construction to convert biomass (piggery effluent) into renewable energy in Northern Victoria. Project has received \$1,000,000 from Victorian Government

Victoria has worked to provide funding and support to encourage new waste infrastructure in the state. In 2014-15, the Resource Recovery Infrastructure fund provided \$6.5 million in funding to encourage large scale recycling facilities focusing on commercial and industrial waste. Both of the shortlisted projects had a PEF offtake that would have been used in energy generation, however both projects fell over during early planning as a result of poor commodities prices.

REGULATION AND POLICY SETTINGS IN VICTORIA

Victoria does not currently have a waste policy, which leaves a gap in the current framework for waste management. Instead, a series of cascading strategic plans, including the Statewide Waste and Resource Recovery Infrastructure Plan (State Infrastructure Plan), provide guidance to the industry on Government direction and priorities.

The regulatory framework is more well-defined with the Environment Protection Act 1970 providing an overarching framework, supported by a raft of subordinate legislation. The *Waste to energy Guideline* (publication 1559) outlines how the EP Act is applied to the assessment of proposals that recover waste to energy in Victoria.

The waste and resource recovery industry has criticised the current waste to energy policy settings in a number of states, including Victoria, suggesting that the existing policies and guidelines are too prescriptive and are not applied with an understanding of the current market conditions. For example, most state-based policies note that waste to energy is only appropriate when there is no economically viable options for recovering the material for recycling. However, there is no definition on what constitutes economic viability, with the industry suggesting low-value materials such as plastics, timber and textiles cannot in many cases be recovered in an economical manner.

The release of the waste to energy discussion paper, which is likely to manifest in new policy and regulatory settings, signals a positive intent from the Victorian Government in addressing the current policy gap.

PART 2 – CONSULTATION FINDINGS

3 CONSULTATION FINDINGS

A series of consultation sessions were held in the development of this report with the intent of capturing different viewpoints from:

- Waste industry representatives
- Local government authorities (LGAs)
- Community members

The following table outlines the consultations undertaken during the project:

Table 1 – Overview of consultation sessions and organisations

Group	Consultees
Waste industry representatives	Veolia
	Suez
	TPI Cleanaway
	Waste Management Association of Australia (WMAA)
	Visy
State government	Metropolitan Waste and Resource Recovery Group (MWRRG)
Local government forum	Hume City Council
	Wyndham City Council
	City of Melton
	Maribyrnong City Council
	Hobsons Bay City Council
	Brimbank City Council
	Moonee Valley City Council
Community consultations	Caroline Springs
	Wyndham

The consultations were undertaken using a structured approach. Waste industry participants were asked about their intentions, progress on waste to energy, plans for Victoria and were further asked to outline any current barriers and blockages that State Government could look to address. Most of these sessions were run in conjunction with pre-briefings held by the DELWP prior to the release of the discussion paper.

Local government authorities from Melbourne's West were consulted via a 2-hour workshop where a presentation on waste to energy was followed by a facilitated discussion on barriers and opportunities. The community consultations were held at public venues and were open to all attendees. Sustainability Victoria provided support in organising the community events.

This section of the report provides the findings of the consultation sessions. These have been grouped around specific themes rather than around each individual consultation session. The intent being to highlight common issues that may assist the Victorian Government in targeting the appropriate investments or interventions.

3.1 Waste industry consultation

The industry participants were understandably well educated in waste to energy applications, with most companies already operating large scale facilities in other countries, mostly across Europe. The following key findings have been summarised from the industry consultation sessions, which we have grouped in themes rather than by specific consultee:

INDUSTRY READINESS

All industry consultees noted that the waste and resource recovery sector is ready to move forward with advanced waste treatment technologies in Australia. Large multinationals, such as Veolia and Suez, noted that they already own and operate many waste to energy facilities in other jurisdictions, mostly Europe. There is a recognition that when the time is right to move forward into procurement, that the sector will respond quickly with both local and international skills on the table.

PREFERRED WASTE TO ENERGY MODEL

Whilst the consultations did not specifically ask participants if they had a preferred model, the conversation often led that point organically. Surprisingly, there was little variation in what is seen as the ideal model by industry players, with all noting a very similar structure, which would include / involve:

- Construction of a facility at a scale of around 300,000 tonnes per annum. This is the right volume to target as it can be achieved on a relatively small footprint, can provide both electricity and district heat and could manage the risk appropriately in comparison to a “mega” plant of 500,000 tonne or more. Smaller “precinct” scale solutions were discussed, however it was noted that the capital expenditure is not sufficiently reduced to make smaller plants economically viable.
- At least 80% of the waste volume required would need to be contracted for at least 20 – 25 years. This means that at least 240,000 tonnes of waste would need to be contracted through municipal waste contracts (local government contracts) for an extended period. This requirements is not only for surety for the plant but essentially is the only conditions under which a contractor could access debt funding for such a facility.
- The remaining 20% of waste could be augmented via commercial contracts and this also provides some contingency for municipal waste generation to grow over the contract period as commercial contracts tend to be no longer than 2 years at the most.

PROCUREMENT AND CONTRACTING

The scale of waste to energy facilities of this nature will require multiple councils to combine their waste and offer this to the market. All of the industry consultees noted the importance of the procurement process, how it is managed, its transparency and the importance of the way in which it is structured.

A key part of this discussion centered on two factors:

- Flexibility: Contracts need to provide flexibility to allow for changes in waste composition, particularly through interventions at government level (for example, the introduction of kerbside collections for flexible plastics would significantly alter the waste composition and its calorific value).
- Transparency: A number of industry participants noted the need for transparency, with one consultee suggesting that some Victorian Government procurement processes for organics waste processing infrastructure have lacked transparency in how decisions have been made and contracts awarded.

The role of MWRRG in the procurement process was highlighted as an important consideration with industry suggesting new skills and resourcing may be required.

IMPORTANT ROLE OF EPA VICTORIA

Interestingly, industry was broadly comfortable with the existing waste to energy policy in Victoria, although it was noted that it had not yet been tested from the perspective of municipal waste treatment at scale. However, it was clear that the industry believes EPA Victoria has a critical role to play in supporting waste to energy projects, both through the approvals process and in the management of waste to energy outputs such as fly ash.

The following key points were raised:

- EPA Victoria must provide clear guidance to the market on where it will draw the line on key items such as pre-sorting, electricity production and requirements for co-generation. The first point is critical as the current policy and discussion paper do not explore this in significant detail but the cost implications could be considerable³.
- There should be genuine engagement between the regulator and the sector on the critical approvals processes, including planning and works approvals and land acquisition of suitably zoned sites.
- EPA Victoria should work proactively with the industry to identify beneficial reuse options for waste to energy by-products, particularly bottom ash and fly ash. This could include development of beneficial reuse criteria and dispensation from landfill levy impacts and ensuring that regulatory settings support genuine reuse opportunities. Market development funding for research and reuse opportunities was suggested by industry consultees.

POWER OFFTAKE AGREEMENTS

A number of consultees noted that the current structure of the power market in Australia remains a critical barrier, suggesting that there is little incentive for power companies to engage with potential waste to energy providers. For large scale facilities to become viable, there needs to be good access to the grid and early negotiation across the energy and waste sectors. There is a clear role for government identified in facilitating these discussions.

However, despite the challenges with grid connectivity it was also noted that the current status of energy supply in some markets, such as the high price for natural gas and poor electricity reliability in South Australia, remain opportunities, with waste to energy able to provide additional capacity to the grid.

Further discussion took place on energy outputs other than electricity, with one consultee in particular pointing to the benefits of industrial steam given Australia has less of a need for district heating which adds to the business case for waste to energy across Europe. There are a number of industrial ecology models where new industrial facilities could be co-located with waste to energy plants (or vice-versa) with the Australian Paper⁴ example highlighted on numerous occasions.

CONSIDERATIONS FOR ALTERNATIVE MODELS

There was a clear signal from some companies, in particular those that operate landfills in Victoria, that the Victorian Government has been too narrow in its approach by targeting only waste to energy technology. It was

³ Note that the strict requirements on pre-sort infrastructure has been a key barrier to development of waste to energy facilities in NSW.

⁴ Australian paper is looking at waste to energy processing which would provide process heat as well as treat residual process waste and potentially commercial and/or municipal waste - <http://www.abc.net.au/news/2017-07-06/australian-paper-latrobe-valley-mill-to-burn-waste-for-energy/8683980>

noted that rather than picking technology “winners”, that government should be setting overarching objectives that articulate what it seeks to achieve, for example reduction in waste sent to landfill or a greenhouse gas related objective. By setting high-level objectives, the industry has the opportunity to respond using a range of different models rather than just waste to energy. One consultee asked *“Why is the government choosing waste to energy, what are they trying to achieve? Is this a landfill diversion objective, an energy objective or a greenhouse gas objective? The response from the market will be different depending on what are the most important objectives.”*

The operator of a large Melbourne landfill suggested that a model utilising mechanical-biological treatment (MBT) or large scale pre-sorting of residual waste to produce a refuse-derived fuel⁵, when paired with improved diversion of food waste through combined food and garden organics (FOGO) collection, could provide significant landfill diversion at a lower cost. It was suggested that at all times the Victorian Government should remain “technology agnostic” so that the industry could provide technology solutions that deliver on the desired outcomes.

COSTS

A critical factor impacting the development of large scale waste to energy facilities in Victoria is the capital and operational costs when compared to current landfill disposal fees. Despite increasing compliance costs and ongoing capital costs for new landfill cell development, landfill gate fees in Melbourne have decreased in recent years. It was suggested that large volume customers such as local governments, can secure landfill disposal at or slightly above the \$100 per tonne mark. Industry consultees quoted an estimated gate fee for waste to energy of about \$180 per tonne, suggesting a large price disparity still exists.

This price gap makes waste to energy at scale currently unfeasible (other than for specified wastes such as medical waste) and this remains the critical barrier to uptake. Industry made a number of points on this topic, including:

- Cost of waste management is directly linked to transportation costs as well as infrastructure costs. A number of industry consultees pointed to the proximity principle as an important consideration when developing and siting facilities, which effectively means that waste to energy plants should be located as close as possible to where the waste is being generated. This reduces overall costs and also amenity issues from long, bulk-haulage of waste across the city.
- Commercial waste will “flow to the lowest cost point” and that will always be a key consideration even if local government can support waste to energy through joint procurement of municipal waste.
- The costs of planning and approvals alone are likely to be in low millions (a figure of \$6 million was suggested based on recent landfill approvals processes) and there may be a role for government in supporting industry with these costs.
- A lack of landfill levy redistribution was highlighted by all industry consultees. The existing pool of funding could be used to improve the business case for investment in waste to energy, both in terms of upfront costs and in overcoming challenges such as end markets for fly ash and bottom ash.

COMMUNITY ENGAGEMENT

Whilst it was recognised by industry that each project must be considered individually on its own merits, it was noted that there is considerable scope for industry and government to work together in community engagement and education. Companies that operate facilities in Europe (such as Veolia and SUEZ) noted the importance of

⁵ Refuse-derived fuel (RDF) is a fuel produced by shredding and mixing “dry” waste streams (mostly commercial waste that is rich in timber, plastic, paper etc) which can be sold as a commodity for use in industrial facilities. For example, ResourceCo in Adelaide produces an RDF which is used in the Adelaide Brighton cement kiln.

early and ongoing engagement with the community as critical to project success, to the point where the community needs to feel that it has informed the decision from the outset. Must come along for the journey, government needs to support applicants in engaging with the community, perhaps not on a project by project basis but at a macro scale through support for new infrastructure development.

Key Industry Consultation Findings

The targeted industry consultation highlighted the following key findings:

- *The sector is ready to invest in waste to energy technology and has the skills to do so, provided that the market and regulatory settings are right.*
- *There appears to be a “preferred” scale for waste to energy facilities across the industry, which sits at around 300,000 tonnes per annum. This size provides the scale to generate profit but keeps risks to a minimum.*
- *Facilities of this size would need to be underpinned by long term contracts for municipal waste, which would need to be structured to share the risk across industry and government. The role of MWRRG is seen as essential for success.*
- *The role of EPA Victoria needs to go further than the existing waste to energy policy. There is a need to ensure that planning and approvals processes can be expedited and that genuine endeavours are made to support beneficial reuses for bottom ash and fly ash.*
- *Government needs to be clearer in setting its overarching policy objectives so that a range of technology solutions, including waste to energy, can be considered by the market.*

3.2 Local government consultation

Targeted consultation was undertaken with local government authorities via a group workshop held at Brimbank City Council. Local government consultees were also relatively familiar with the technology but were extremely well versed in the requirements (and economics) of municipal waste management.

The LGA session covered a broad range of topics with representatives sharing concerns about how the move forward to waste to energy would occur. It should be noted that a key topic of conversation related to the expansion of Ravenhall, specifically how such a move would undercut any progress on waste to energy by keeping landfill costs at a level too low for other approaches to compete.

In general, the LGAs consulted were supportive of waste to energy as an alternative to landfill but cautioned on the need for early planning and also questioned whether the timelines for such infrastructure would make any impact on local issues in the short term. There was also some discussion about the focus area, which should not necessary be just on waste to energy but on the key issues, such as getting food waste out of the residual waste bin which would reduce costs and improve amenity of existing facilities.

SPECIFIC CONSULTATION WITH WYNDHAM CITY COUNCIL

Reincarnate attended a separate consultation session with Wyndham City Council at their request. Wyndham is in a unique position as the only local government owner of a large metropolitan landfill at Werribee. It was noted that a works approval to extend landfill activity at the site (within its current footprint) was granted in October 2017 which has caused some community concern.

Wyndham City Council noted that despite the approval to extend landfilling, the community remains keen to move away from landfill and that council is supportive of this provided that it can still generate a return for the community. In this regard, council has suggested that the existing site could be used for alternative waste management given its planning conditions and buffer zones, however a planning scheme amendment would be required as incineration is currently not permitted at the site. The western group of councils has reportedly already commenced discussions about what a joint procurement for residual waste might look like with the current Werribee site as a proposed location.

It was noted during the consultation that the current landfill costs are not necessarily a significant constraint for councils. Essentially there is nothing stopping groups of councils from moving away from landfill, provided that the community is prepared to absorb the additional cost (estimated to be around \$60 per tenement). This would simply require councils to sign up to long-term contracts, which is already the case for the joint landfill disposal contracts orchestrated by MWRRG.

Wyndham City Council highlighted a significant role for state government in supporting such a move, including:

- Potential rate capping relief
- Bridging the funding gap, for example via a public private partnership or other means
- Bringing Geelong into consideration as part of a western procurement
- Supporting the planning and approvals process
- Reinvesting landfill levy funds to reduce the cost impact on the community (grants, rebates etc)

Key Local Government Consultation Findings

The targeted local government consultation highlighted the following key findings:

- *Waste to energy is supported, however the policy settings need to recognise the whole waste hierarchy, with more investment needed to promote waste reduction, increase recycling and improve education.*
- *The political risk for infrastructure like this is large and government needs to share the risk with industry, including finding suitable sites, sharing the costs and supporting procurement.*
- *The timelines for implementation would be considerable, at least 5 years but likely more, obtaining planning permits, works approval and licensing would take up most of this time.*
- *Location and siting of facilities needs to be considered. From a cost perspective they would need to be close to the source of waste generation, but the community might not be ready to see “stacks” in some areas.*
- *State government should look to bridge the funding gap, for example via a public private partnership or other means, using landfill levy funding which is currently not released back to the market.*
- *Victoria should be learning from the best models worldwide and bringing this knowledge home.*

3.3 MWRRG consultation

Prior to commencing the community consultation, discussions took place with MWRRG in relation to the development of a business case for residual waste processing in Melbourne. The business case will inform future joint tendering of residual waste processing (i.e. technologies other than landfill disposal) and is predominantly targeting the south-east of Melbourne which has declining landfill airspace and a lack of options for further airspace to come on line.

The key findings from the consultation with MWRRG include:

- There is a clear role in the policy framework for joint procurement activity, both through the State Infrastructure Plan (SWRRIP) and the Metropolitan Waste and Resource Recovery Implementation Plan (Metro Plan).
- The South-east is the priority due to the declining landfill airspace (around 15 years left), which could be preserved to deal with the residual waste coming out the back of a waste to energy facility.
- The development of organics processing facilities which have already led to significant additional capacity should not be undermined by waste to energy. Treatment of residual waste should focus on non-organic material, with food and garden organics channelled into the existing facilities for processing into compost and going back to the land.
- There is scope for landfill levy funding to lessen the impacts on rate payers, which are estimated to be around \$60 per tenement
- The landfill levy is a good mechanism, but the landfill BPEM can also be used to drive diversion from landfill via increased scrutiny

3.4 Community consultation

Community consultation was undertaken via two facilitated sessions, incorporating some early presentation of subject matter followed by open and small group discussion on the relevant issues.

Essentially, the consultation was structured around the following questions:

What is most important to you in how we manage the waste we generate in Melbourne?

What role do you think the role of landfill should play in how we manage waste in Melbourne?

What role do you think waste to energy can play in how we manage our waste in Melbourne?

What do you see as the advantages of waste to energy?

What are your concerns about waste to energy?

The raw findings from the consultation sessions are presented below, followed by a summary of key findings.

CAROLINE SPRINGS AND SURROUNDING AREAS CONSULTATION

The first session at Caroline Springs was run using a world café style format, where participants moved around the room, stopping at various stations which had one of the five questions outlined above. Small group discussions were undertaken, notes put on butchers paper and then each station reported back at the end of the session. At the end of the session, each participant was given red stickers to pick their highest priority item from all of the points raised.

1. What is most important to you in how we manage the waste we generate in Melbourne?
 - Need to focus on increased recycling and reduced waste, such as plastic packaging
 - To have a low impact locally
 - There should be disclosure requirements for all residential developments so buyers know of waste facilities before purchasing
 - Community should be engaged in decisions on waste management, not enough publicity or notice for consultations
 - Be clean and fair for all communities
 - All waste, irrespective of how it is disposed of should not be disposed on one major site
 - Transparency is essential, the community should know the waste that goes in and what comes out
 - Environmental justice is important – a shared responsibility in dealing with a problem that is caused by ALL Victorians
 - The Western Suburbs is not a dumping ground
 - We need to break the waste “cartels”
 - Solutions need to ensure the community can benefit from waste (as a resource)
 - Consider community owned models
 - Not one solution, but a range of solutions
 - In NSW, they build houses in their old quarries, why do we get a landfill?
 - Should be a “reasonable” distance between waste facilities and residents
2. What role do you think waste to energy can play in how we manage our waste in Melbourne?
 - Has a role as the last resort after reuse and recycling and reduction
 - Produce electricity
 - Needs to be strategically located
 - It’s a good idea
 - Reduce smell and impacts to local residents
 - Reduce litter from trucks and Ravenhall site
 - Reduce contamination from birds
 - Eliminate smells
 - Environmental justice should be encouraged. Different locations means shared responsibility
 - Part of the multiple solutions
 - It can improve the future of our country
 - Provides jobs

- Stop publicly listed companies from taking the easy way to deal with waste
- Stop large landfills from being located in one area
- Makes different localities accountable from their waste
- Important role after education. Society to create less waste in the first place.

3. What do you see as the advantages of waste to energy?

- Can deliver more energy
- Can be attractive from a design perspective
- Stop the dirty linear economy and close the loop, need to move to a circular economy with waste to energy only for the residual waste at the end of the chain
- Shared responsibility and environmental justice – the whole community can participate in solutions instead of just dumping in the West
- Happy communities who suffer from landfill and would benefit from waste to energy
- More employment opportunities for local communities
- Better for the environment in the long term, considering landfill takes 200+ years to decompose (some plastics more than 1000 years)
- Less smell
- Buyers won't get ripped off by greedy developers and a lack of disclosure
- Could reuse wasted land that was previously landfill
- Less rubbish
- Less health impacts on employees as opposed to landfill
- Better for the environment including ground water, air, better for people, less stress.
- Less putrescible waste to landfill
- Residents won't have to put up with odour, ill health, stigma and reduced property values
- Can produce electricity
- Tri-generation of energy
- Keeps energy resources close to industry, for example Visy Coolaroo
- Lessens transport emissions if there are multiple plants so that waste is not moving across the state
- More stringent controls over emissions than at a landfill, waste to energy would have constant stack emissions monitoring and reporting

4. What are your concerns about waste to energy?

- Must be regulated, plants maintained
- Will the technology vary across the state?

- Location and size relative to residential areas
 - Concerns about air toxins and air quality, land contamination and ground water contamination
 - It could destroy the recycling industry
 - Increase in costs and rates
 - Who will fund the infrastructure?
 - What happens to the ash?
 - Can't just be one massive plant, must be smaller facilities across Victoria so the impacts are shared
 - There will still be lots of trucks
 - No push from MWRRG, they just want to keep burying waste
 - The heat could be used locally so the community can benefit
 - Can they explode? Are they dangerous?
 - Will there be a consistent pricing structure across the state?
 - How long will it take to implement and will this get buried in election promises
5. What role do you think landfill should play in how we manage waste in Melbourne?
- Less landfill. We need a waste management plan (policy) that does not use one site as a dumping ground for the whole state.
 - Locations should be dispersed and manage local waste only
 - Minimal landfill to manage waste which waste to energy plants can't manage, right at the bottom of the waste hierarchy
 - "Mega" landfill sites such as Ravenhall should not exist, especially near residential areas
 - The money collected from landfill levies should be used to improve the environment it has damaged. This is money not being used in the West who suffer.
 - Above ground landfills ruin the landscape. Mega-landfills attract vermin and birds, they cause major environmental damage. We want a sustainable solution. Landfill is the old technology and needs to be kept to a minimum.
 - Very little landfilling at all, should have no impact on surrounding communities.
 - Re-energise our communities for HOPE. No longer allow profits to go to ASX listed companies who allow the locals to bleed.
 - Landfills kept to a minimum and should not be located within 10km of residential areas, irrespective of what waste it takes.
 - Landfill is a "last resort"
 - Hold a government forum into waste, bring in the industry and community, offer incentives for creativity – waste to clean energy, invite the whole of Australia to participate.

At the completion of the world café sessions, the group was asked which two issues were the most important to explore further. These were decided to be environmental justice and shared responsibility for waste and the need for dispersed locations for facilities. The following provides to raw findings from a 10 minute follow-up discussion on these two topics:

1. Environmental justice and shared responsibility

- Local government issue
- Facilities for waste should be in all areas of Melbourne and regional Victoria
- Education is essential to people understand more about waste, where it goes, how it is managed
- Valuing waste, via rates based performance (i.e. charging by weight)
- Waste is a resource
- Full life cycle of waste considered by the community, looking at packaging and moving away from disposable items
- Social justice for future generations (i.e. ensuring the impacts of waste are shared across the community and not left to future generations to repair)
- EPA has a role in community justice
- Embrace the polluter pays principle
- Environmental justice also for wildlife not just us

2. Need for dispersed locations (i.e. not just one mega site)

- Who will pay for the satellite waste to energy locations? Could increase costs
- Landfill levy needs to be reinjected back into the community
- Who will run the facilities?
- Community benefit must be an outcome / output
- Possible funding model – a pool of council's contribute plus state funding to raise capital
- MWRRG has this info already
- Local community and residents need to benefit from money raised by the levy

HOPPERS CROSSING AND SURROUNDING AREAS CONSULTATION

The second session at Hoppers Crossing was much smaller, and as such a round table discussion was held covering a variety of topics. The raw comments from the sessions are presented as follows:

- Council has a role in educating residents about waste – more info about what to do with plastics and plastic bags
- Communities need to be more responsible for managing their own waste, rather than sending it all west – motivation to reduce and recycling waste
- Environmental justice is important

- Consider system design that work in small neighbourhoods
- Opportunity to create growth through reduce / reuse / recycling
- Look at examples / approaches in times of water shortage
- Towards zero waste for grant funding opportunities
- Fully explore closing the loop for our products
- More effective way of dealing with soft plastics
- A system for managing waste we can be proud of
- Legislation that reduces waste to landfill
- Schools should be forced to have recycling bins
- Opportunities for improved sorting and diversion
- Lack of awareness about what happens to our waste
- Protecting birds and wildlife
- Health implications of toxins in the air
- Waste reduction in the first place – industry packing and product stewardship, community behaviour around consumption
- Is there a market in Australia for recycled plastic
- What are the known dangers of waste to energy
- How much more would waste to energy cost?
- How many waste to energy centres would we need
- Where will the facilities be located, not just in the west!
- Is the technology really that innovative?
- How much energy will they create? What happens to the ash?
- Can we put a price on landfill?

Key Community Consultation Findings

The targeted community consultation highlighted the following key findings:

- *Consultees noted that more needs to be done to respect the waste hierarchy and promote waste avoidance, reuse, then recycling and only then the disposal of residual waste. Victoria needs to move toward a circular economy. The government collects considerable amounts of money from landfilling and this is supposed to be reinvested into these activities.*

- *The community is supportive of waste to energy as an alternative to landfill, but the risks must be recognised and managed. This includes air quality and environmental protection. There are concerns about how the end products, such as fly ash, will be managed safely and effectively.*
- *There is a genuine push for the idea of environmental justice and shared responsibility from the community in Melbourne's West. All Victorians generate waste and managing it should be everyone's responsibility with solutions that benefit the community.*
- *The consultees do not support the current model of single site "mega" facilities. The move toward waste to energy must support distributed models where multiple facilities are used as a network that process local waste, rather than a large facility that processes all waste.*
- *The decisions and planning related to waste to energy must be transparent, equitable and not disproportionately impact one community or area.*
- *The interaction between waste management facilities and the community must be managed better. There should be clear separation of activities, no facilities near residential development and regulations that protect residents from buying property without knowledge of waste facility locations (mandatory disclosure requirements)*
- *Landfill should only be used for residual waste (for example after treatment by waste to energy) and not as the default for all waste*

4 CONCLUSIONS

This project was not seeking to produce a fundamental set of findings, ultimately this will be the role of the current waste to energy discussion paper which is out for consultation. It was intended to seek specific, targeted feedback on waste to energy development, particularly in Melbourne's West, where the extension of existing landfills has caused significant community concern.

The following summarises the key findings from this project, which have informed the theoretical Case Study developed in the next section of the report:

Summary of findings

- *There is broad support for waste to energy as an alternative to landfill in Melbourne. This is shared across industry, local government and community stakeholders. However, the community in particular has concerns about how the technology works, what risks it might lead to and how the hazardous outputs such as fly ash and filter cake will be managed.*
- *Community and local government consultees have made it clear that the Victorian Government should be doing considerably more to address upstream issues of waste generation, through improved education, reuse and increased recycling. At almost all consultations this was listed as critically important, with residual waste treatment being referred to as "the last resort".*
- *Residents of Melbourne's West have made it clear that the burden and impacts of waste management should be shared more fairly across the community. Having "mega" waste sites (either landfills or otherwise) is not appropriate and the concept of environmental justice, which calls for shared responsibility and intergenerational equity, should be embraced. Waste to energy facilities should therefore be located across Melbourne and regional Victoria, servicing local and regional communities.*
- *The industry has suggested an ideal model for large-scale waste to energy, which would involve facilities at a scale of around 300,000 tonnes per annum, of which 80% of the waste would need to be contracted for at least 20 years. This highlights the important role of MWRRG in securing the required feedstock.*
- *Industry and local government both highlighted the cost disparity between waste to energy and landfill (which is in the order of \$80 - \$100 per tonne) as a critical barrier, however at least for municipal waste treatment this could be overcome through collaborative tendering of local government waste. Interestingly, barriers associated with planning approvals, works approvals and licensing were highlighted as being the most challenging issues, suggesting that EPA Victoria would need to play a far more proactive role in supporting projects than it currently does.*
- *Industry consultation also suggested that the Victorian Government should remain technology agnostic, and instead focus on setting clear objectives and goals that the market could look to achieve with a broad range of technology solutions. It was suggested that the absence of an overarching waste policy does not give the sector confidence in the government's direction.*
- *The disposal of organic waste to landfill is the highest priority, given it is the largest contributor to amenity issues such as odour. Steps to remove organic waste from landfill disposal will reduce community impacts and facilitate development of alternative waste treatments such as waste to energy in Victoria.*

PART 3 – CASE STUDY



Waste to Energy

A case study in Melbourne's West

Introduction



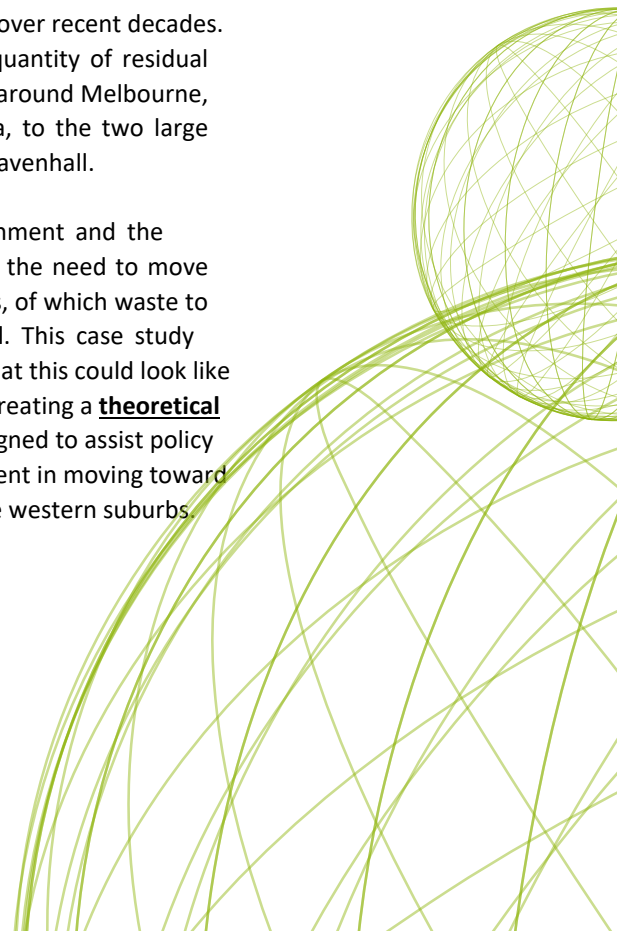
Waste to energy could be the alternative to landfills in Melbourne's West

Communities in Melbourne's West have expressed concerns about the impact of large landfill facilities, a number of which have recently received approval for long-term expansion. Well managed landfills provide a relatively cheap, safe and effective means for disposal of residual waste. However, poor land use planning has brought landfills into close proximity with large residential developments in Melbourne's West, which brings with it issues of amenity, particularly odour, and the impacts of truck movements, noise and other issues.

Victoria generates some 12 million tonnes of waste per annum, of which around 4 million is disposed to landfill. At present, there are no other alternatives for residual waste across the state, despite many international jurisdictions

moving away from landfill over recent decades. In addition, a significant quantity of residual waste is bulk hauled from around Melbourne, and from regional Victoria, to the two large landfills at Werribee and Ravenhall.

Both the Victorian Government and the community have signalled the need to move toward landfill alternatives, of which waste to energy is the most logical. This case study provides an example of what this could look like for Melbourne's West by creating a **theoretical** exemplar project. It is designed to assist policy makers and local government in moving toward a low-landfill future for the western suburbs.



Project Overview

Councils come together for waste to energy

In 2018, eight councils in the west and north-west of Melbourne undertook a joint procurement for waste disposal, with a stipulation that only “non-landfill” disposal options would be considered. This was the first large scale move away from the landfilling of municipal waste in Melbourne.

The councils collectively took around 300,000 tonnes of kerbside residual waste to the market, seeking responses that offered:

- value for money
- improved environmental outcomes from waste
- reduced amenity impacts for local communities
- reduced greenhouse gas emissions

After a tender period of some 12 months, EnergyCo was awarded the contract in early 2019 based on a typical combustion waste to energy facility. The facility will be one of a network of facilities across the north, east, south-east and west of Melbourne, providing a more equitable spread of waste management impacts on the community.

Site selection

To assist tenderers in identifying suitable parcels of land to construct a waste treatment facility, the eight participating councils nominated several parcels of industrial zoned land with good transport links. These sites were located within the metropolitan Melbourne boundary to ensure that transport costs and emissions could be minimised.

The preferred sites chosen for the new facility were the existing Werribee landfill precinct and MRL Ravenhall site due to the current land use, existing buffers and strong community support to move away from landfilling at the site.



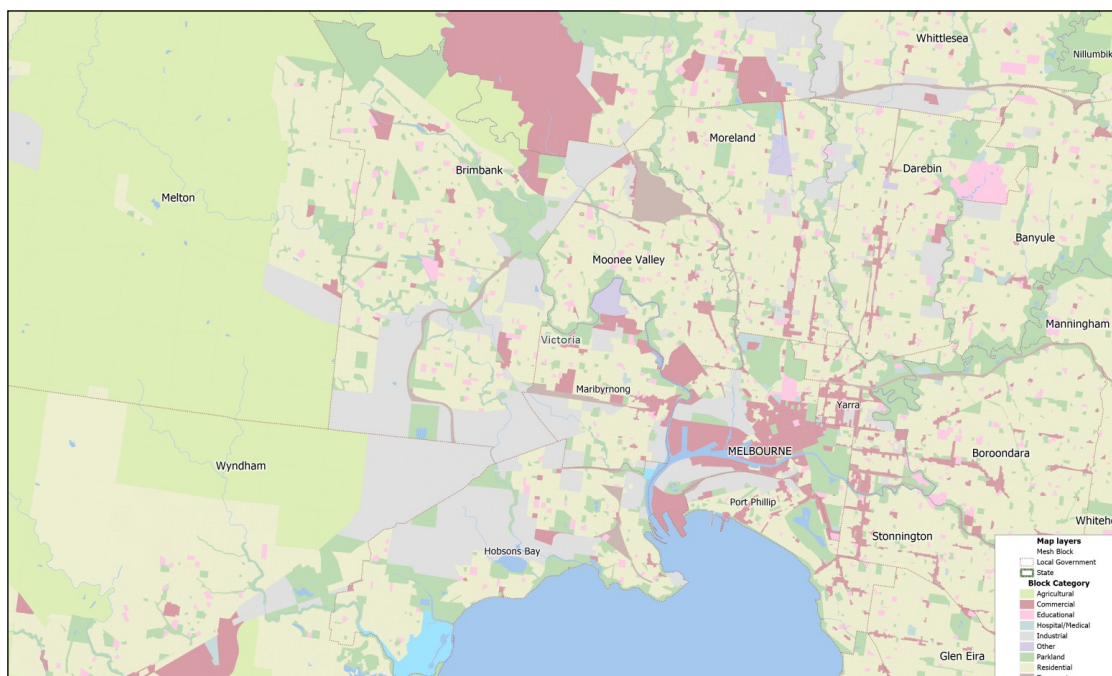
Technology considered

The procurement process was “technology agnostic”, which means that a technology solution was not nominated in the tender documents. Rather, a series of criteria was used to set objectives and allow the market to respond accordingly. The following technology models were nominated by tenderers:

Waste to energy - processing residual waste using thermal technology.

Mechanical-biological treatment - processing residual waste by sorting and digestion of organic waste.

Landfill presorting - mechanical sorting of waste prior to disposal to landfill.



Project Details

EnergyCo Solution

EnergyCo proposed a standard waste to energy facility using moving grate combustion technology. Essentially, this is a simple process where residual waste moves down a “walking grate” into a combustion chamber where it is incinerated at high temperature. The thermal heat generated through the process is used to create electricity and process heat for a large industrial facility located nearby.

The plant operates across four distinct phases:

Phase 1 - Material handling

Waste collection vehicles arrive at the facility and tip their loads into the large tipping chamber. A mechanical arm is used to mix the waste and transport it to the feed-in hopper.

Phase 2 - Combustion

Waste moves from the feed-in hopped down the moving grate through the combustion chamber. Waste is incinerated at around 900 degrees Celsius in about 2 seconds.

Phase 3 - Power generation

Heat from the combustion process generates steam which in turn powers a turbine, creating around 28MW of electricity (enough to power more than 35,000 homes). An additional 40MW of heat is also produced which is transported to a nearby industrial facility.

Phase 4 - Environmental controls

A series of air scrubbers is used to clean gas before discharge via the flue, removing particles and hazardous substances.

Project Details

The project can be summarised as follows:

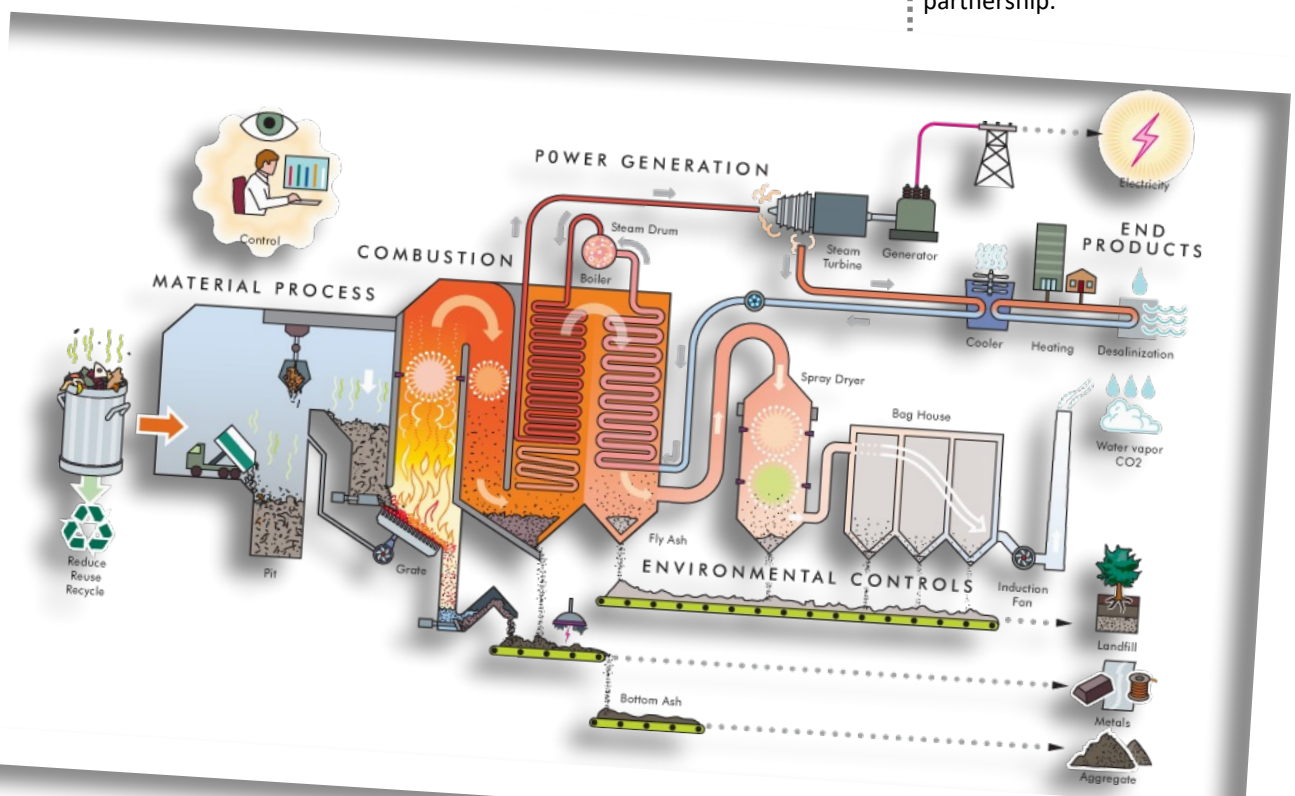
Possible Locations: Werribee Landfill Precinct; MRL Ravenhall

Plant Capacity: 350,000 tonnes per annum (300,000 tonnes municipal waste, 50,000 tonnes commercial waste). Generates 28MW of electricity at 40MW of heat.

Technology: Moving grate combustion facility, operating at 900C with a burn time of 2 seconds

Contract length: Eight councils contracted in total. Contract length 20 years, with five councils initially and the remaining three joining within the first 2 years of operation (as existing contracts are closed out)

Cost: Facility was constructed at a cost of around **\$220 million**, which was financed using a public-private partnership.



Community Engagement

Getting community buy-in

A community engagement program was undertaken from the very start of the process, commencing prior to the release of the tender and being maintained throughout the design, construction and operation phases.

It was essential for the eight councils to ensure the community was supportive of the move away from landfill. Initially, open consultations were held with the community to discuss the following key questions:

- What do you expect from waste management in Melbourne's West?
- What is important to you about the waste management system?
- What role should landfill play in how we manage our waste?
- What other technologies could we consider?

These initial sessions then led to more targeted consultation with the community on waste to energy facilities. The following key requirements came out of the targeted consultation which informed the tender process:

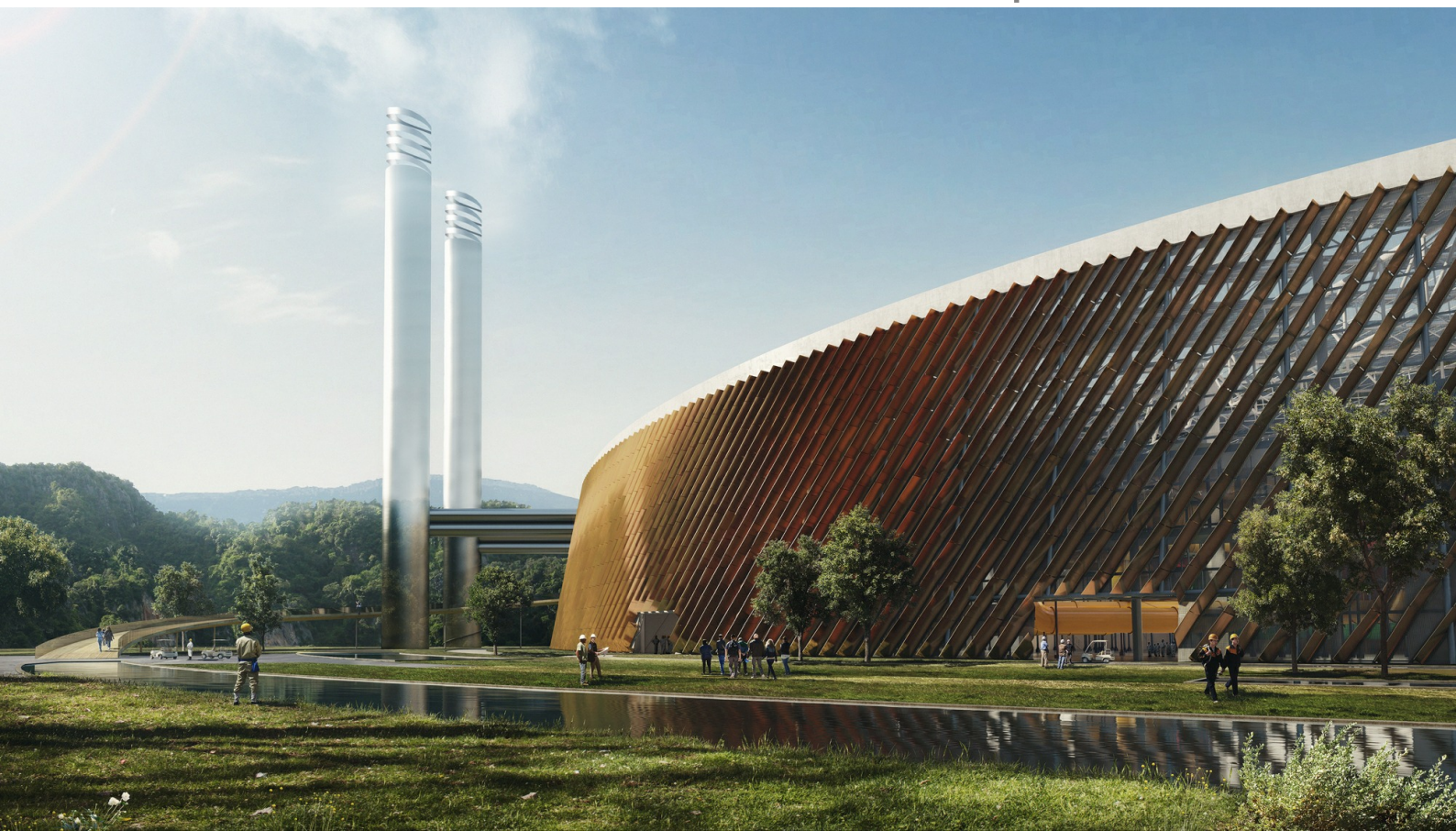
- The community supports waste to energy, provided that the risks are managed and that there is transparency over risks and decisions.
- Waste to energy should only be used for residual waste and there should be more investment on waste reduction, reuse and recycling initiatives to reduce the amount of residual waste being generated.
- The principle of environmental justice should be considered, specifically that the management of residual waste should be a shared responsibility for all Victorians.
- The facility should be aesthetically designed and add value to the community.

Project Design

A significant portion of the community engagement process was focused on how the facility should look and operate. Being located in the existing landfill precinct limited public use options, however designers were encouraged to consider appropriate public space.

Ultimately, the design was developed with considerable public buy-in. A number of options were presented and voted on, with the final design incorporating large feature stacks complemented by a diagonal facade around the whole facility.

The final design is presented below.



Managing Risks



Risks are known and appropriately managed

Waste to energy facilities present a range of risks and challenges that must be managed appropriately. The facility for Melbourne's West has been designed to manage the risks and outputs in line with the EPA requirements as follows:

Bottom ash

The residual ash at the base of the furnace is referred to as "bottom ash". It contains heavy metals and is tested regularly for hazardous material. Most of the bottom ash can be reused in road base and brick making. The facility generates around 60,000 tonnes per annum of bottom ash, of which about 60% is recovered for reuse. The remainder is disposed to landfill.

Fly ash

Ash created higher in the chamber is referred to as fly ash. It generally contains toxic metals such as lead, cadmium, copper and zinc, along with dioxins and furans. The facility generates around 10,000 tonnes of fly ash per annum and this is sent to a hazardous waste landfill for disposal.

Air emissions

Air emissions created from the combustion process are managed through the spray dryer and bag house, in which a series of chambers and filters are used to clean the air of any hazardous or toxic substances. About a third of the total cost of the facility is focused on environmental controls like these. The emissions that are left are primary water vapour and carbon dioxide which are expelled via the emissions stack.

Approximately 35,000 tonnes of material (10%) still requires disposal to landfill.

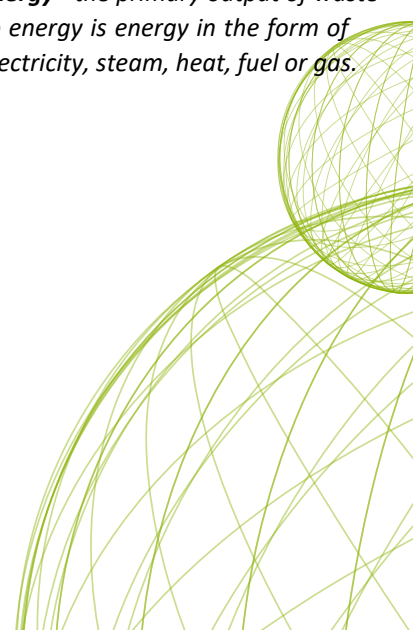
Facility outputs

The combustion of waste produces three primary outputs:

Air emissions - emissions from waste combustion include NO_x and SO_x as well as airborne particulates.

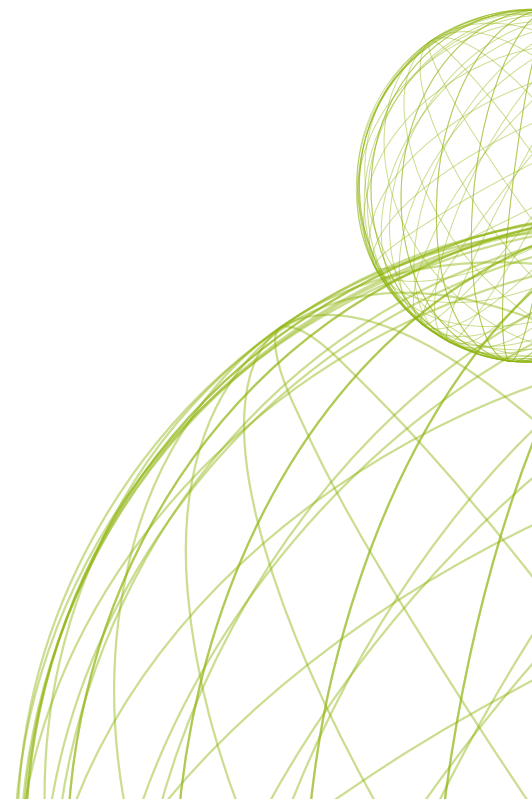
Ash - combustion does not destroy all waste, with around 15 - 25% remaining as bottom ash and fly ash, some of which is classed as hazardous waste.

Energy - the primary output of waste to energy is energy in the form of electricity, steam, heat, fuel or gas.



Project Timeline

Project timeline from planning to completion





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