ADVANCED WASTE PROCESSING

The introduction of Advanced Waste Processing for the management of Municipal Solid Waste

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Forward

The Municipal Engineering Foundation Victoria (MEFV) annually allocates scholarship awards to successful Victorian municipal engineering practitioners to research a wide range of internal and overseas study topics, with a focus of the award being attendance at the American Public Works Association Annual Congress as part of a study tour of municipal service organisations within USA and Canada.

The purpose of the scholarship is to provide opportunities for engineers working in local government in Victoria to enhance their technical and managerial skills. The awardees are required to prepare a detailed report on the experiences and knowledge gained from the study tour on their return to Australia to share with Victorian Local Government and Public Works professionals.

The 2018 MEFV USA & Canada Study Tour involved three scholarship recipients accompanied by an MEFV Trustee who attended the American Public Works Association Annual Congress, providing valuable guidance mid-tour.

The scholarship recipients and respective study tour topics are:

- Daniel Kelabora (Senior Project Engineer, Latrobe City Council) – Disruptive Technology
- James Kelly (Manager Delivery and Assets, Banyule City Council) – Engineering Leadership
- Les Stokes (Operations Manager, Melton City Council) – Advance Waste Processing

Claudio Cullino accompanied and supported the scholarship recipients at the American Public Works Association Annual Congress in the role of MEFV Trustee.

Acknowledgements

I wish to express my gratitude to the Trustees of the Municipal Engineering Foundation of Victoria for selecting me to participate in the Study Tour. I would specifically like to thank Claudio Cullino & Geoff Glynn, trustees of Municipal Engineering Foundation for their guidance, advice and support prior to, during and post tour.

Furthermore, the opportunity to attend the 2018 APWA International Public Works Congress was invaluable, I was exposed to numerous educational sessions on Municipal Public Works and Leadership as well as the opportunity to attend networking sessions and form ongoing professional relationships with Public Works professionals from around the world.

A sincere thank you to all the organisations for hosting and sharing their knowledge and experiences. We encountered a real willingness to engage in discussions and we thank them for their preparations and site visits.

I am also grateful to the Melton City Council, and specifically Mr Luke Shannon, General Manager – Planning & Development, in supporting my leave to participate in the study tour and by providing financial assistance for my attendance at the APWA Congress.

Study Tour Cities and Host Organisations

The 2018 MEFV USA & Canada Study Tour visited the following cities and host organisations:

- City of Edmonton
- Enerkem
- City of Minneapolis
- Hennepin County
- City of Kansas
- City of Oklahoma
- City of Tulsa
- Convanta
- City of Houston
- Trans Houston
- City of Austin
- Austin Resource Recovery
- City of Frisco
- Cityworks - GIS
- Drive.ai

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Executive Summary

Advanced Waste Processing for the treatment of Municipal Solid Waste is rapidly gaining momentum in Australia, with many states in various stages of planning, design and construction. Municipalities in Metropolitan Melbourne are starting to be involved in the planning and implementation of Advanced Waste Processing facilities, with Municipal Engineers actively involved in determining their individual Council's involvement in the planning, procurement and in some instances operation of these facilities.

The Study Tour visited three Advanced Waste Processing facilities in North America:

- Enerkem Gasification Plant – Edmonton, Alberta CA
- Hennepin Energy Recovery Centre (HERC) - City of Minneapolis, Minnesota
- Covanta Waste to Energy Facility – City of Tulsa, Oklahoma

Each providing a contrast of learning opportunities due to the variety of technologies in use, the age of the facilities and the more importantly the maturity of the policy context in which they operated. In addition to visiting Advanced Waste Processing facilities the tour also visited the City of Austin, Texas. The State of Texas has a zero waste to landfill goal, at the same time banning the use of Waste to Energy facilities, forcing a focus on higher order waste avoidance and minimisation initiatives. The data collected shows that this approach in isolation is very slow to take effect and will see significant volumes of waste going to landfill over the next 10-20years.

The study tour was significantly beneficial to me and gave me exposure to the use of Advanced Waste Processing for the treatment of Municipal Solid Waste. I was able to study its application, success and role in the overarching waste hierarchy of various jurisdictions. The visit to the City of Minneapolis and the Hennepin Energy Recovery Centre affirmed that Advanced Waste Processing is a real and achievable solutions to Melbourne's landfill reduction targets whilst not adversely affecting the ability to avoid and minimise waste in the future.

Summary of findings

- Investment in Advanced Waste Processing infrastructure should be supported by funding from the Sustainability fund.
- Advanced Waste Processing can and should play an important role in reducing Metropolitan Melbourne's waste sent to landfill.
- Under the right policy structure, Advanced Waste Processing should not undermine higher value waste avoidance, minimisation and recycling efforts. These policy structures already exist in Victoria, in the form of an avoidance based Waste Hierarchy that is enshrined in the Environment Protection Act
- Higher order Advanced Waste Processing technologies, such as Gasification that capture and repurpose material from waste should be favoured over the sole production of electricity. Noting that is will be predominately be market driven.
- The location of Advanced Waste Processing should consider end users of the facility's outputs, taking advantage of secondary outputs such as heat and stream.

1 Introduction

1.1 Scope

Advanced Waste Processing is known by many terms, such as Waste to Energy, Advanced Waste and Resource Recovery Technology, Alternative Waste Treatment or Advanced Resource Recovery Technology. For expediency, this report will use the term Advanced Waste Processing.

Advanced Waste Processing for the treatment of Municipal Solid Waste is rapidly gaining momentum in Australia, with many states in various stages of planning, design and construction. The purpose of my study tour sort was to gain an understanding of the Waste and Resource Recovery systems in which facilities operated including the Community involvement and Legislative framework that underpinned use of these facilities.

This report seeks to provide guidance to practitioners involved in the planning and implementation of Advanced Waste Processing facilities in Metropolitan Melbourne, addressing specifically:

- Effects of Advanced Waste Processing on the Waste Hierarchy
- Drivers for the introduction of Advanced Waste Processing
- Issues and Challenges with the introduction and ongoing operation of Advanced Waste Processing

1.2 Advanced Waste Processing

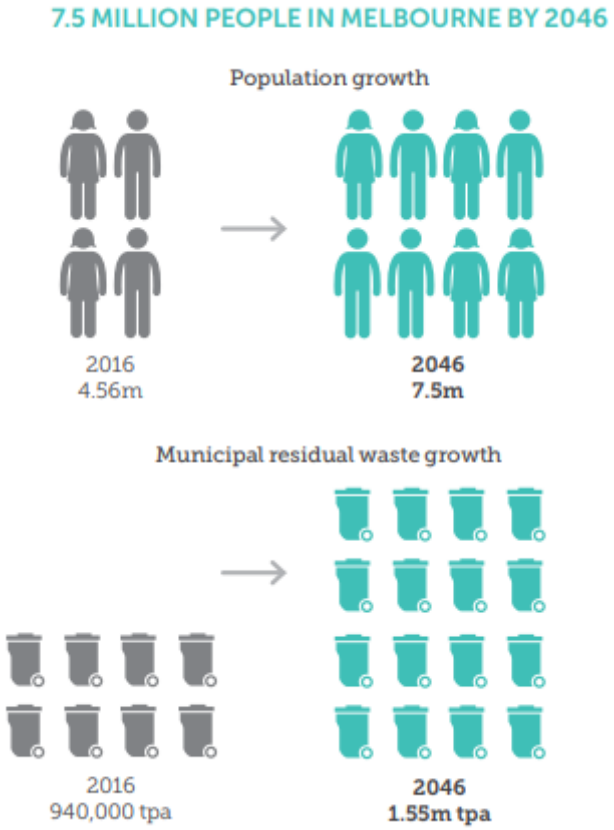
Advanced Waste Processing solutions are sophisticated technologies that recover more resources from waste compared to landfill or basic recycling sorting. These technologies bridge the current gap between recycling and sending kerbside waste to landfill.

Whilst this report is not seeking to provide an analysis of the various technologies that constitute Advanced Waste Processing, it is important to understand that that there are technologies that simply convert waste to energy (and in some cases provide heat to district heating systems) and other more sophisticated technologies that seek to capture and repurpose/reuse gases, liquid fuels and solid fuels that are embodied in the waste.

There are many type or variances of Advanced Waste Processing technologies, the study tour visited both incineration and gasification plants, with incineration being the most common. Incineration burns the waste, creating heat which creates steam that drives a turbine that generates electricity. Gasification produces combustible gases, known as Syngas. This Syngas can either be combusted to heat water, creating steam and therefore energy or can be further processed into chemicals such as Methanol and Ethanol.

2 Melbourne Context

Melbourne's Population has been growing significantly and will continue to do so, with 7.5 million people predicted to call Melbourne home by 2046. The State Government predicts that municipal solid waste (garbage collected from households) will grow by 65% over this time. This will have a significant impact if Government, Council's and the Community don't look for new ways to manage the waste we produce.



SOURCE: Advanced Waste and Resource Recovery Technologies, Metropolitan Regional Business Case and Procurement Strategy, Metropolitan Waste & Resource Recovery Group

The Metropolitan Waste & Resource Recovery Group (MWRRG) is a Victorian State Government Statutory Body that, amongst other things, works with Melbourne's 39 Metropolitan Council's to plan for waste management and resource recovery facilities and services.

MWRRG has accessed the Sustainability Fund to prepare a business case for Advanced Waste Processing infrastructure that can divert Melbourne's kerbside waste from landfill. The business case established that:

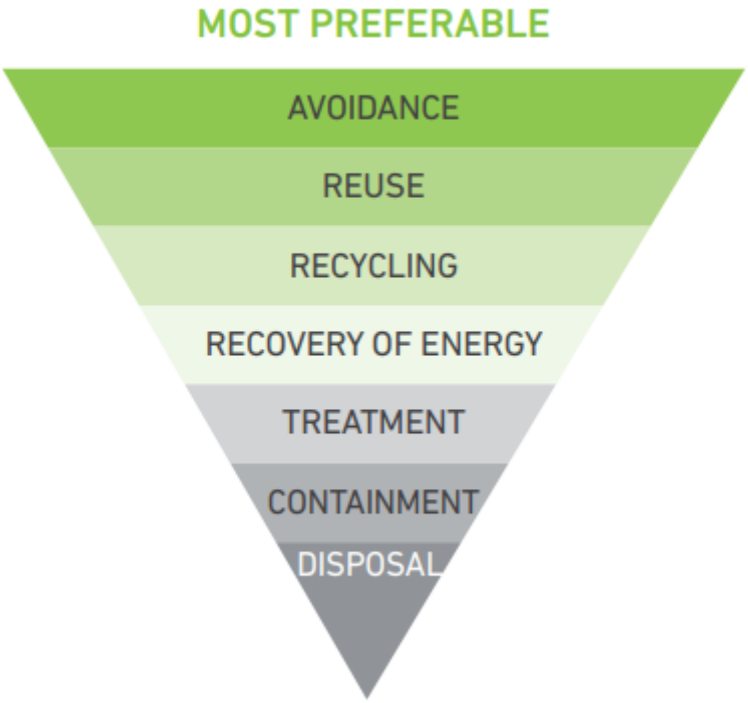
- these technologies will limit the amount of waste sent to landfill and will achieve a 25% recovery of waste.
- food and garden organics (FOGO) recycling is important, but on its own will not achieve landfill diversion targets.
- advanced waste processing will deliver better environmental and social benefits compared to landfill.

Essentially the Business Case established/confirmed the market viability of Advanced Waste Processing Technologies in Metropolitan Melbourne and provides a framework to assist Council's to

partake in a procurement process to facilitate its establishment. The next step being to partner with MWRRG in development of a detailed cluster business case and ultimately a multi-phase joint procurement process.

2.1 Victorian Waste Hierarchy

The Victorian Waste Hierarchy is one of the principles of environment protection that is contained within the Environment Protection Act 1970. The hierarchy is designed to guide decision making and investment with the order of preference focused on Avoidance as the most preferable and disposal (e.g. landfilling) the least preferable.



There are concern amongst some that the introduction of Advanced Waste Processing in Melbourne may disrupt the Waste Hierarchy and rapidly become the preferred method of Waste Management. Taking the pressure of the crisis ridden recycling industry and undermining efforts to reduce the production of waste in the first place. This is a valid concern and must be front of mind when Advanced Waste Processing is being implemented, practices can be controlled by policy and can therefore protect the Waste Hierarchy. This report further investigates this topic and compares the actual implementation of Advanced Waste Processing in both highly constrained and policy free settings.

3 Tour Visits

The selection of study tour cities involved detailed research to ensure a variety of experiences could be gained, testing different applications of Advanced Waste Processing in various stages of operation and in differing waste management policy settings.

The visit to Edmonton was aimed at seeing a newly developed site with a high value processing technology. Whereas, Minneapolis and Tulsa were both older Waste to Energy plants, one operating in an environment of a strong policy driven waste avoidance hierarchy and the other in a relatively policy free waste management setting. Finally, the visit to the City of Austin tested the ability for a city to achieve zero waste to landfill without using Advance Waste Processing.

This section of the report analyses each visit and the information gained through discussions, presentations and further research following the tour.

3.1 Edmonton – New Frontier in Advance Waste Processing

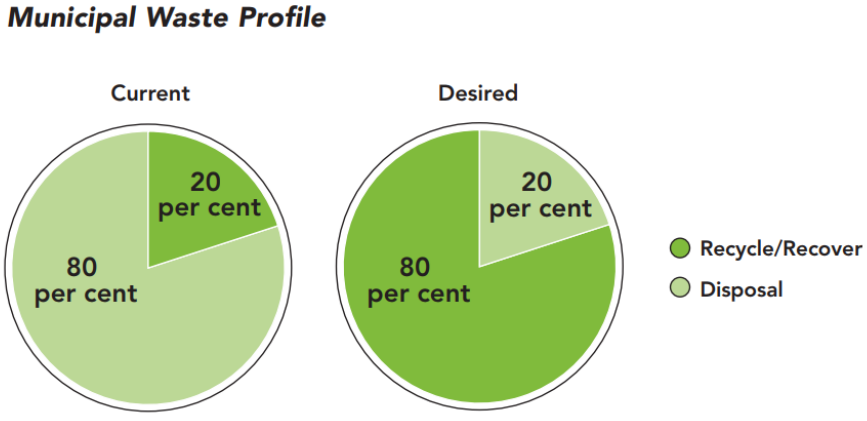
Edmonton has a population of approx. 932,000 and is the capital of Canada's Alberta Province. It is the fifth largest city in Canada, and is the gateway to the North West petro-chemical extraction areas of Alberta. Its' Oil Sands deposits are the third largest in the world and has driven rapid growth and increased demand on services to sustain this growth, including the waste management. The tour visited the City of Edmonton including the new Gasification Plant operated by Enerkem, the plant had only just commenced full operation.

3.1.1 Alberta Province - Waste Strategy

Alberta has a Waste Strategy that is focused on Conservation, titled "Too Good to Waste". The 20year Strategy, developed in 2007, adopts a basic Waste Management Hierarchy of:

1. Waste Reduction
2. Re-use
3. Recycling – Energy recovery should only be considered for materials with high heat value and no recycling options
4. Disposal – Landfilling and incineration without energy recovery are examples of alternatives when other options are not feasible

The Strategy sets a basic goal of 80% diversion from disposal.



SOURCE: Too Good to Waste, Making Conservation a Priority – Government of Alberta

Alberta's Strategy identified very similar challenges to those that we experience here in Australia. Albertans have little incentive to reduce waste generation and disposal. Waste has traditionally been viewed as somebody else's problem. They have increasing become a throwaway society and these challenges are further exacerbated by the pressures of its booming economy. They have diversion programs for specific waste streams that have been introduced to solve specific problems and whilst these programs have been successful, they haven't addressed the issue of landfilling residual waste.

The strategy developed several actions to force the reduction of waste and the development of alternatives to landfill. Alberta introduced financial instruments to discourage waste disposal to landfill, developed options to fund resource recovery infrastructure and developed a policy for energy recovery from waste.

The following Waste to Energy technologies are allowed in the Alberta by the Policy and are regulated by the Environmental Protection and Enhancement Act:

1. Anaerobic Digestion (Organics – Biogas)
2. Gasification (MSW – Chemicals or Power Generation)
3. Incineration (MSW – Power Generation)

Gasification with the production of Ethanol and Methanol is Advanced Waste Processing of the highest order and therefore cost.

3.1.2 Waste Management in Edmonton

The City of Edmonton is currently diverting approximately 50% of residential waste from landfill primarily through recycling and composting. They have a long term target of 90% diversion from landfill. The Enerkem Waste to Biofuels and Chemicals Facility will help the City increase the diversion rate by approximately 20%.

Enerkem Waste to Biofuels and Chemicals Facility – Edmonton, Alberta CA

Edmonton has a two bin system available to its residents, with kerbside recycling has been provided since the late 1980's. Kerbside waste is transported to a Materials Recovery Facility (MRF) where it is sorted into three streams by manual and mechanical means. The organic materials are transferred to the Edmonton composting facility, the metals and cardboard materials for recycling, and the non-compostable and non-recyclable waste is moved to plant where a Refuse Derived Fuel (RDF) is produced. A mechanical system in the RDF plant prepares and shreds the solid waste for use as feedstock for the bio-fuels plant.

Refuse Derived Fuel production – Edmonton Materials Recovery Facility

The City of Edmonton annually supplies 100,000 tonnes of sorted and dry municipal solid waste to the Enerkem plant under a 25-year agreement. The feedstock for producing biofuels is municipal solid waste that cannot be recycled or composted (i.e. waste that has traditionally been sent to landfill).

In 2009 the local City of Edmonton Landfill reached capacity and closed, resulting the City of Edmonton having to transport its residual waste, 80km to the next nearest landfill in Ryley, Alberta. The closure of this landfill was one of the main market enablers for this facility with the cost to the City of Edmonton on landfilling rising to CA$111/tonne. Noting that this is not dissimilar to issues in Victoria, Australia, with landfill levees increasing significantly, the closure of several landfills and the State Government's positon not build any new landfills.

The City of Edmonton pays CA$127/tonne to provide the Refuse Derived Fuel to Enerkem. Although the cost is slightly higher than landfilling, the city benefits from being able to claim reduced greenhouse gas emissions as well as avoiding the emission of methane from landfilling, which is a particularly dangerous greenhouse gas.

Enerkem began construction on the plant in August 2010 and it was completed in the first half of 2014. The facility has been undertaking a substantial testing and approvals process and only recently receive the approval to operate. The estimated cost of the project is CA$80 million. The plant created more than 600 direct and indirect jobs during its construction, receiving funding of CA$32.35 million from the government and the City of Edmonton.

The Edmonton experience has many similarities to those of Metropolitan Melbourne, the market for Advanced Waste Processing has been created by the closure of landfills and the rising costs of landfilling. Like Melbourne, ongoing growth and infrastructure development continues to a growth in quarrying of construction materials. Whilst this creates opportunity to fill these spent quarries with waste to landfill, environmental concerns regarding landfilling is driving the move away from this practice. The implementation of higher order Advance Waste Processing technology such as gasification is also market driven and therefore should be left for Processors to determine.

3.2 Minneapolis – Established and leading the way

Visits to the City of Minneapolis and the Hennepin County included a tour of the Hennepin Energy Recovery Centre (HERC). The HERC is a Mass Burn Combustion Waste to Energy plant (Incinerator), located on the edge of downtown Minneapolis. The Facility was established by the Hennepin County in 1989 and is now operated by Covanta Energy, incinerating household waste to create energy to the grid and heat to the neighbouring baseball stadium.

HERC receives residential and commercial solid waste, including all of the residential solid waste from Minneapolis. Current controls limit the HERC to processing a maximum of 365,000 tons of solid waste per year.

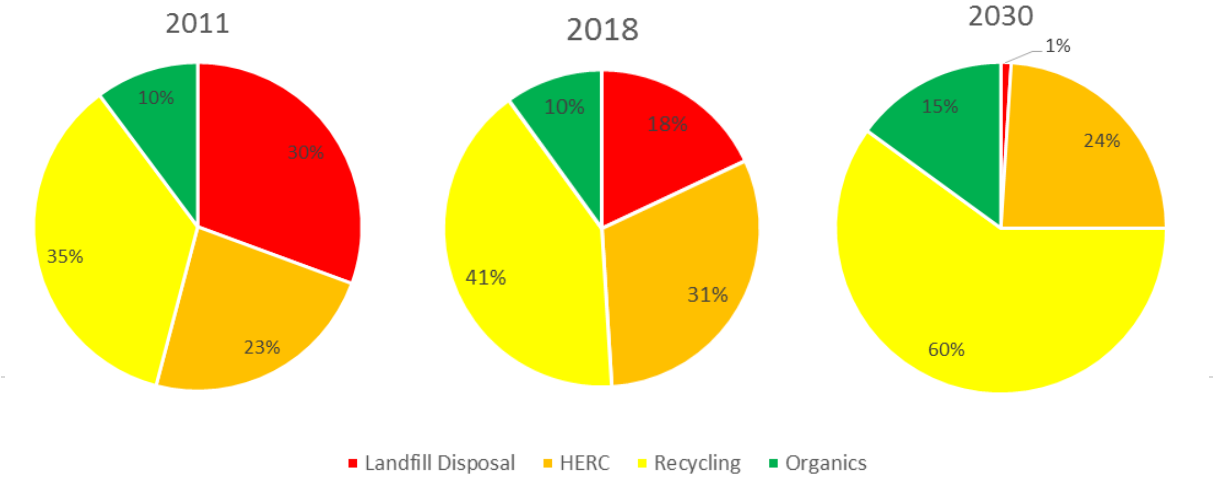
Municipal Solid Waste handling inside the Hennepin Energy Recovery Centre

3.2.1 Minnesota State Policy

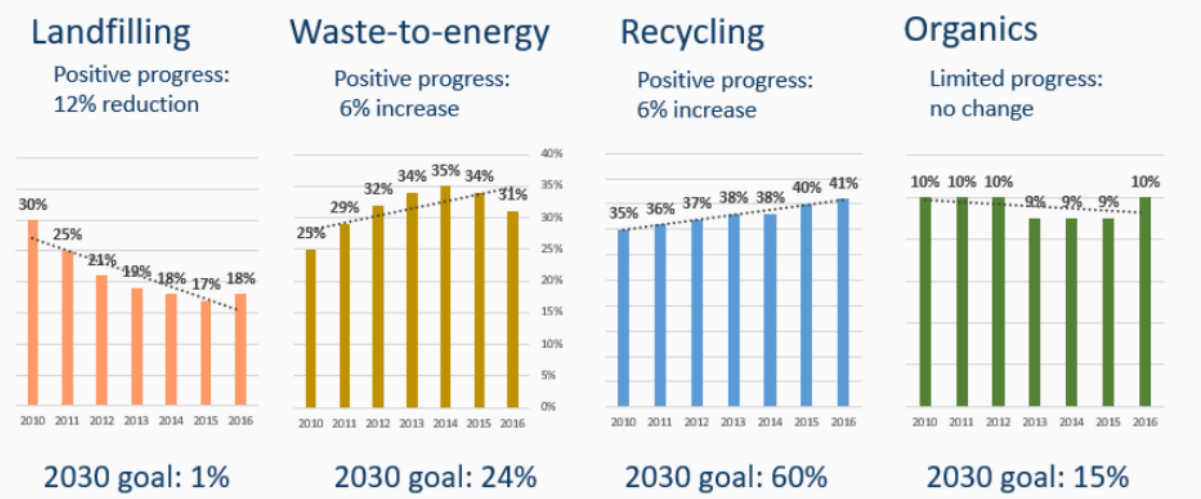
The State of Minnesota's Waste Management Act and the Metropolitan Solid Waste Management Policy outlines aggressive goals, including specific and quantifiable objectives for eliminating the practice of landfill disposal of mixed municipal solid waste and requires Counties to prepare master plans the identify strategies to meet these goals and objectives. The policy outlines objectives that maximize the upper end of the waste hierarchy, emphasizing product stewardship, source reduction, and reuse, and achieving the legislative goals for recycling and organics recovery.

3.2.2 Hennepin County Waste Management Plan

In 2018, Hennepin County adopted a Solid Waste Management Master Plan that is aimed to set the county of the path to zero waste to landfill. The master plan reinforces the Waste Hierarchy and despite benefiting financially from having Waste converted to Energy, the Hennepin County are actively seeking to reduce the amount of waste processed by HERC. Hennepin County current divert 82% of Waste from landfill, with the HERC processing 31% of the total waste volume.



This master plan is a second generation plan, with the first being adopted in 2010. Given the apparent aggressive nature of the 2030 goals it is good to understand the County's success to date over the six year life of the first plan. The graphs below show the annual percentage of waste volumes in the areas of Landfilling, Waste-to-Energy, Recycling and Organics Recycling (including yard waste).



A reduction in landfilling from 30% down to 18% is an amazing success story, particularly when half of the material is now being recycled. Even more telling is that whilst landfilling has remained static over the last 2-3years of the plan, waste processed at the HERC reduced and this volume was instead recycled.

The waste management strategies applied in the Hennepin County are clearly working and creating rapid improvements is waste management by the community in this area.

The Minneapolis experience should arrest any concern that Advanced Waste Processing will, by its' introduction alone, disrupt the waste hierarchy and adversely affect waste reduction, avoidance and recycling. Clearly, a well-developed strategy with goals and objectives that support a strong State adopted waste hierarchy, creates a framework for successful landfill diversion and increased recycling.

In order to fully understand how relatable the Minneapolis experience is to Metropolitan Melbourne, it is worth exploring the strategies employed by the Hennepin County and challenges they seek to address.

Hennepin County identified that its ability to meet a recycling goal of 60% will be impacted by trends in the waste management and recycling industries, including changes in packaging, processing cost increases and volatile commodity pricing. These trends are all relevant to Melbourne and currently being experienced across the globe.

Despite this challenge, they have identified that opportunities to divert material from Municipal Solid Waste still exist. The following group of strategies will lead Hennepin County's waste diversion efforts and make further progress toward state goals:

- Focus on organics, including increasing organics recycling and reducing food waste.
- Build momentum for waste prevention and reuse.
- Engage residents through outreach and education.

- Serve residents where they are (at home, at work, at school, at events and on-the-go)
- Promote drop-offs for hazardous waste and additional recyclables.
- Divert construction and demolition waste from trash.
- Recover resources from trash.
- Achieve more through collaboration.
- Lead by example in county operations.

Almost all of these strategies are relevant to Metropolitan Melbourne and in fact directly aligned to current Victorian State Government policy direction. For example, the Hennepin County intend to provide residents with the opportunity to recycle food and garden organics by 2022, not dissimilar the introduction of FOGO services that is happening across Melbourne.

The County continue to ensure a focus on waste prevention and reuse, although acknowledging that this is about building a momentum that will have a longer term payoff. They continue to engage and educate the community on Waste Management Services and ensure that services are provide to residents in an accessible way.

The discernible difference between the strategies within the Hennepin County Plan and those within Melbourne's Metropolitan Waste and Resource Recovery Implementation Plan, is that of the allocation and commitment of funds to infrastructure improvements that enable the delivery of the strategies. The Hennepin Plan nominates investment by the County to assist City Council's deliver for example,

- "Provide $100,000 of funding for city organics recycling drop-offs annually through 2021"
- "Assist three to five cities to finance and implement organics recycling pilots to address barriers, test alternate collection methods, and evaluate different aspects of an organics recycling program"
- "Continue offering $750,000 per year in business recycling grant"

Whereas the Metropolitan Melbourne Implementation Plan is less committal, using language like "partner with" and "support investment". Melbourne will not reach its objectives without investment in infrastructure and a freeing up of the sustainability fund will assist the delivery of this.

3.3 City of Tulsa – Established but …..

The study tour visit to the City of Tulsa included a tour of the Waste to Energy Facility operated by Covanta. Covanta's facility commenced operation in 1986, now converting 1,125tonne/day of Municipal Solid Waste into steam energy that is provided directly to a neighbouring oil refinery. The facility was originally constructed when landfill space in the City of Tulsa became scarce, the City established the Tulsa Authority for Recovery of Energy (TARE) to run the facility.

The City and the TARE board has three basic forms of landfill diversion:

1. A kerbside recycling collection service that focuses on four products –
    - Aluminium & Steel Cans,
    - Paper & Cardboard,
    - Rigid Plastic, and
    - Glass jars & bottles.

    With a motto that seeks to address their high contamination rates (22%) of "When in doubt, throw it out."

2. The waste-to-energy facility
3. A household Chemical drop off facility

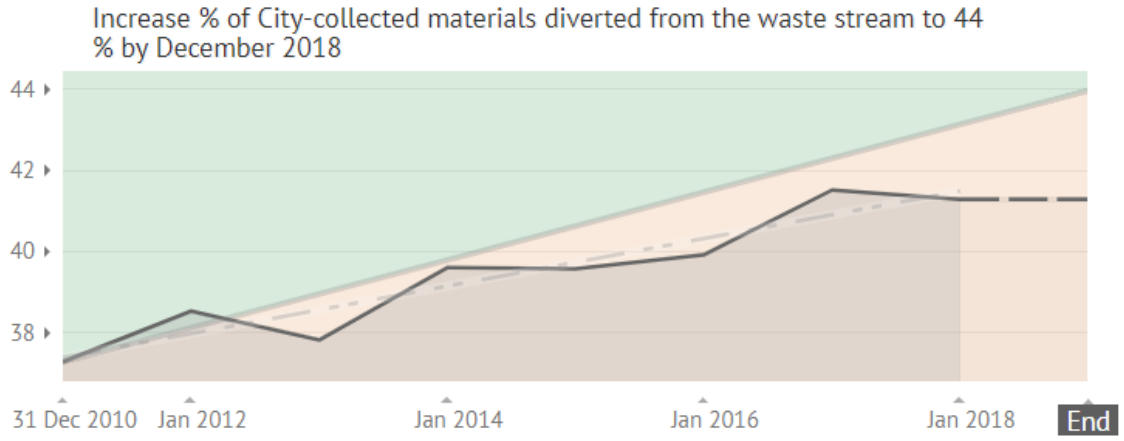
The City of Tulsa residents only recycle 16% of their household waste with the rest going to the Waste to Energy facility. The City of Tulsa view Waste to Energy as "recycling" and believe the early introduction of the now 30year old facility showed great foresight. They believe it has made their community sustainable and as the population grows, so does the volume of waste that goes on to make more electricity.

The State of Oklahoma and the City of Tulsa have no waste management strategies or documented waste hierarchy. The City has no real waste avoidance and reduction program, other than a residential kerbside system that is a "pay-as-you-throw" system, which could be seen as provide a financial incentive not to produce waste. Anecdotally, it seems that the lack of policy direction and education of its residents and their willingness to embrace Waste to Energy as a form as recycling has a direct correlation to the very low resource recovery rates.

3.4 Texas – Advanced Waste Processing, NO WAY!

The Study tour visited three cities in the US state of Texas, Austin, Houston and Dallas. This leg of the tour did not involve the visitation to any Advanced Waste Processing facilities, due to the fact that the State of Texas has a zero waste goal that excludes Advanced Waste Processing. This gave the opportunity to instead investigate the alternatives to Advanced Waste Processing and the ability to still achieve "zero waste" goals without the use of this technology.

In 2009 the City of Austin Council adopted the first Zero Waste Strategic Plan in the state of Texas, committing the City to achieve zero waste by 2040. In December 2011, the City Council adopted the Austin Resource Recovery Master Plan to help implement the Zero Waste Strategic Plan. The Master Plan calls for the City to move from 38% waste diversion to 75% by 2020 and 90% by 2030. This appears to have been a very ambitious goal with the City currently achieving 41.32% diversion (2018). In effect the City has only managed to move increase diversion by 3% in 7 years. The City of Austin maintains that its behaviour change initiatives are the best approach and continue to invest in these.



SOURCE: City of Austin Open Data Portal

The Master Plan explicitly states that both landfilling and Waste to Energy technologies such as incineration are not part of the City's vision for zero waste and are therefore not part of any future planning for the city.

The City of Austin's decision to focus solely on prevention and avoidance of waste appears not have resonated with the general public and, based on current trends, they are unlikely to ever achieve their goal of zero waste without a change in strategy or an overwhelming change in the behaviour of residents.

As we go about our day to day lives as consumers of goods and materials it is almost impossible not to produce waste. To instantly prevent waste would therefore take a complete turnaround in the wants and needs of society, a rapid move to towards post-consumerism. Unless this shift is forced by government regulation and control or by a significant climate event that changes the mindset of an entire population base, it will not occur quickly. Post-consumerism is more likely to occur over generations and in the meantime Advanced Waste Processing can provide an alternative to landfilling whilst waste reduction measures take effect.

4 Key Learnings and Discussion

4.1 State Government Investment

Advanced Waste Processing is a significant capital investment, it was a consistent finding that for all facilities visited, higher levels of government, whether it be State, Provincial or County have made significant financial contributions to the establishment of Advanced Waste Processing even in recent time, e.g. Edmonton. There was no sole reliance on private investment to establish these facilities. The Victorian State Government has control over and access to the Sustainability fund for direct investment in Waste Management Infrastructure, and Advanced Waste Processing technologies should be a prime candidate to receive this funding.

4.2 Strong Policy direction

The establishment of strong policies that support all aspects of landfill diversion and not just waste avoidance is required. From the City of Austin experience, it appears that it will take generations for waste reduction through minimisation and avoidance to have a real effect. That is not to say that minimisation and avoidance are a futile pursuit, but rather a longer term aspiration.

Therefore, Alternative Waste Processing technologies such as Waste to Energy can play an important role in reducing waste to landfill now, even if for only in the short to medium term (20-30years). Waiting for and relying solely on behavioural change will see millions of tonnes of waste going to landfill in the immediate future.

The stark contrast between the Minneapolis experience and that of Tulsa, showed the importance of a Waste Hierarchy that forms the foundation of all Waste Management practices and investment. Both Cities established Mass Burn Combustion Waste to Energy facilities at similar times, both with similar motivations, i.e. to address the lack of landfill space available for Municipal Solid Waste. Yet the absence of State and Local Government policy commitment to waste minimisation, has seen the City the Tulsa achieve very poor recycling and resource recovery rates. This is in contrast to the apparent success of the City of Minneapolis and the Hennepin County, who have managed to maintain a waste hierarchy that is aligns with minimisation objectives and continue to strive to reduce waste treatment at the Hennepin Energy Recovery Centre. The City of Minneapolis is proof that Advanced Waste Processing can be successfully implemented as a tool to minimise waste to landfill whilst not undermining an avoidance-based hierarchy.

The State of Victoria has a Strong Waste Hierarchy that is enshrined in legislation, there are strong strategies, plans and guidance documents within State Government departments that are well placed to deliver outcomes that mirror those found in Minneapolis.

4.3 Advanced Waste Processing Technologies

It was not the aim of this report to assess various technologies and form a view on a preferred type of Advanced Waste Processing for Melbourne, however the study tour did see a number of facilities and some findings should be discussed. Waste Treatment is a market driven proposition, different

technologies have different costs and the output of the processes have a value that give a return on the initial investment.

Ideally, higher order processing technologies that produce more than just electricity, such as gasification, should be favoured as they at least recover material from the waste that would otherwise be lost. The siting of facilities can also assist in the creation of markets for the output, i.e. colocation with end users of either electricity, steam, heat and chemicals will increase the viability of the plant. It makes sense therefore to plan Victoria's Advanced Waste Processing facilities in industrial centres, for example, where businesses producing pre-cast concrete exist or adjacent to large institutions like hospitals and universities that require a significant amount of heat.

4.4 The Recycling Industry

All cities visited confirmed the crisis triggered by the China National Sword Policy was a global issue. This overseas experience did not show a shift of material from recycling to Advanced Waste Processing, that is, there was no apparent increase in "recyclables" being process into energy. The fall out in Victoria, with recyclables being temporarily landfilled, has significantly undermined the perception of recycling in our community. It would therefore not be unreasonable to consider that if Advance Waste Processing existed in Victoria right now then this waste would probably have ended up at these facilities rather than landfill. There is a risk that this would promote a view that Advanced Waste Processing has the potential to undermine the recycling of waste products.

This adds further importance to ensure investment at all levels of the waste hierarchy and target programs that ensure the success of recycling. The recently launched Municipal Association of Victoria action plan to "Rescue Our Recycling" is a good example of such action. Municipalities must ensure that have a Waste Strategy that is aligned to the waste hierarchy and practitioners must ensure they continue to pursue improvements in recycling within their municipalities, regardless of whether or not they are implementing Advanced Waste Processing. Participating in group procurement contracts for recycling processing, increasing the use of recycled materials in Council daily activities and increase community education are all examples of initiatives Council's should consider

5 Conclusion

The Study tour was a fantastic opportunity to gain an understanding of Advanced Waste Processing in Canada and the United States of America. The tour confirmed that Melbourne is well positioned to commence utilisation of this technology to reduce waste to landfill. However, it should not be seen as the sole solution to the problem but rather a significant step in the right direction. The State of Victoria and Local Council's should continue to invest is other landfill diversion programs such as Food Organics recycling. As well as waste minimisation, avoidance and recycling initiatives.

Given that the State Government has identified the need for and likely success of Advanced Waste Processing in Metropolitan Melbourne it must consider the use of the Sustainability fund to support its development, as was common practice at the sites visited by the tour.

Advanced Waste Processing technologies, such as Gasification that capture and repurpose material from waste should be favoured over the sole production of electricity. The location of Advanced Waste Processing should consider end users of the facility's outputs, taking advantage of secondary outputs such as heat and stream.