INFRASTRUCTURE PARTNERSHIPS AUSTRALIA

PUTTING WASTE TO WORK:
DEVELOPING A ROLE FOR ENERGY FROM WASTE

INFRASTRUCTURE PARTNERSHIPS AUSTRALIA

Infrastructure Partnerships Australia

Infrastructure Partnerships Australia is an industry think tank and an executive member network, providing research focused on excellence in social and economic infrastructure. We exist to shape public debate and drive reform for the national interest.

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Infrastructure Partnerships Australia would like to acknowledge the contributions of Robert Montgomery and Lydia Robertson to the development of this paper, as well as others across the infrastructure sector who provided guidance and feedback.

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EXECUTIVE SUMMARY

About this report

In the face of recent international waste market disruptions, Australia's waste management system needs a clear, nationally coordinated and forward-looking response. Recent decisions made by the Council of Australian Governments (COAG) provide some clarity around national objectives on waste management, but more work is required by governments of all levels.

As part of this response, Energy from Waste (EfW) and other forms of energy recovery technologies can play a role – as they have in other countries for many years. But governments need to take steps to support the rollout of energy recovery facilities and systems in a way that encourages investment and works in the best interests of the community.

This paper seeks to build on and cut through the plethora of waste and circular economy strategies developed over recent years to provide a clearer path forward for energy recovery in Australia.

The paper calls for action across a broad range of energy recovery and advanced processing technologies. There is an explicit focus on EfW, as this form of energy recovery has faced distinct challenges in building community support and establishing clear rules to guide development of new facilities. By ensuring the full range of waste management options are considered, as well as setting a market and rules for their implementation, governments can unlock greater private investment and innovation to address Australia's growing waste challenges.

Australia has a waste problem

Australia is facing a crisis in waste management, caused by a combination of policy, planning and economic factors.

A historical lack of national attention and coordinated policy has left Australia without the means to effectively manage and reap value from the waste we create. Decades of inconsistent and fragmented waste policy have held back investment in the sector and extended reliance on landfill instead of more sustainable practices. Progress is being made, but the reduction in core waste production on a per-capita basis is being cancelled out by population growth.

Compounding this challenge are restrictions set by China on imported recyclables, as well as clampdowns in other countries including India, Indonesia and Malaysia, culminating in a waste export ban being set on many types of our waste. This waste export ban means Australia will have to manage millions of tonnes that we previously shipped overseas. Our waste is no longer someone else's problem.

Appetite among community and industry stakeholders to reform the waste sector is growing in response to decreasing tolerance for landfill and increasing social awareness of related issues. This is occurring in conjunction with large infrastructure operators and investors providing significant capital and expertise to meet Australia's waste challenges. With the right policy settings, these factors could be leveraged to create enduring change within Australia's waste sector.

What is Energy from Waste?

Energy from Waste – also known as waste to energy – refers to the process of converting residual or non-recyclable waste into sources of energy including heat, fuel and electricity. The term covers a broad range of thermal and biological processes, which vary in scale, as well as the relevant inputs and outputs.

Energy from Waste is a missing piece of the puzzle

Much of our waste that cannot be re-used or recycled, known as residual waste, is simply sent to landfill. As a nation, we need to reconsider how we generate and use waste. Waste should be treated as a valuable resource that can be put to further use. EfW is not a form of waste disposal, but an opportunity to extract value from waste through energy recovery.

Although Australia has some EfW facilities, these are predominantly small-scale bioenergy plants. There are two large-scale EfW facilities under construction, with the Kwinana Waste to Energy Project (see Case Study 1) in Western Australia set to be the nation's first utility-scale EfW facility, to be launched in late 2021. The East Rockingham Resource Recovery Facility, to be located a short distance from the Kwinana facility, also commenced construction in early 2020 and is scheduled to become operational in late 2022.

Other proposals for large-scale facilities are under development across the country, but many face regulatory, planning and commercial hurdles. Notably, the Eastern Creek facility proposed by waste management company Dial-A-Dump for Western Sydney was refused planning approval by the NSW Independent Planning Commission in July 2018 based on perceived environmental impacts and community resistance. A new proposal for an EfW facility at Eastern Creek, put forward by Cleanaway and Macquarie Capital's Green Investment Group, is due to be considered by the NSW Government in 2020.

Source: ARENA

Case Study 1: Kwinana Energy from Waste facility

The Kwinana facility in Western Australia will be the first large-scale thermal combustion EfW facility in Australia.

The $698 million project, which was co-developed by Macquarie Capital and Phoenix Energy, will convert 400,000 tonnes of post-recycling household, commercial, and industrial waste into baseload energy to the grid – with a total output capacity of 36 megawatts.

Macquarie Capital brought together a consortium of non-traditional lenders, including debt financing from the Clean Energy Finance Corporation. The project also received a $23 million grant from the Australian Renewable Energy Agency.[1]

In building the commercial case for the project, the WA Local Government Association selected the Kwinana facility as its preferred supplier of baseload renewable energy.

The project is also supported by 20-year waste supply agreements with Rivers Regional Council, which represents seven local governments, and the City of Kwinana.

The project relied heavily on the engagement of international expertise. This included advice from the UK-based Green Investment Group, which has invested in over 30 EfW facilities in Europe and has extensive experience in the asset class.

A significant amount of work was undertaken to obtain environmental approvals and a social licence to operate, incorporating international best practice such as the EU Industrial Emissions Directive.

Construction of the facility, being undertaken by Acciona, commenced in 2018 and is due for completion by late 2021.[2] Veolia will operate and maintain the facility over a 25-year contract.

Governments are waking up to the waste crisis, but more guidance is required

Over the last 18 months, Australia's governments have started to realise the importance and urgency of rethinking how we manage our waste.

Released in March 2020, COAG's *Response strategy*[3] to the waste export bans provides a number of commitments by governments to address the nation's mounting waste management challenges. This builds on the *National waste policy action plan*, released in late 2019, which put forward a number of national targets on resource recovery and recycling, as well as a commitment to ban the export of waste plastic, paper, glass and tyres from mid-2020.

Waste management and circular economy strategies have also been released – either in draft or final form – over the past 12 months by the state governments in New South Wales,[4] Victoria,[5] (including a separate report by Infrastructure Victoria),[6] Queensland,[7] Western Australia[8] and Tasmania.[9]

These recent strategies have taken great strides towards a nationally coordinated approach to waste management, and the outcome-based targets set through COAG will help to provide direction across governments and industry on common goals.

However, there is still a lack of clarity and consistency about waste management technologies in these government plans. Only some strategies openly address EfW and steps required to support its implementation, most notably the reports by the Victorian Government and Infrastructure Victoria. Most strategies do not provide sufficient information or advice to support further action in each respective jurisdiction.

The lack of a nationally coordinated approach means that, even if investors and operators can proceed with an EfW facility in one jurisdiction, developing similar projects in other jurisdictions will require a whole new approach, bringing additional cost and complexity to project development. Many of these projects are complex to build and operate, with major risks across feedstock demand, energy supply, and other factors. Social licence to operate these facilities may also be challenging to obtain, especially in urban areas.

Strong government leadership is required to drive change

Successfully embedding an appropriate role for EfW in Australia requires governments to provide greater clarity to the industry on the role of EfW, and confidence through policies and regulations that take a long-term view. A lack of clarity could deter investment in the emerging sector, resulting in poorer waste management outcomes, or delays and inefficiencies that will ultimately add to costs for industry and taxpayers.

Industry cannot build community support for EfW on its own, so governments must show leadership in guiding engagement on the reforms and potential investments that will underpin growth in EfW in Australia. This requires action by governments of all levels.

Rules about feedstock for EfW facilities could help to ensure operators have sufficient waste, while also ensuring forms of waste higher up in the hierarchy, such as recycled materials, are retained for higher value uses. Further, emissions standards around the design and operation of EfW plants, including ongoing monitoring and reporting obligations may be necessary to fully capitalise on the emissions reduction benefits of substituting away from landfill.

If Australia's governments fail to support the development of further EfW facilities and other forms of energy recovery as part of a waste management solution, more of our waste will simply end up in landfill. The result would be a need for more landfill sites, the emission of more greenhouse gases, and substantial environmental, economic and financial costs. This would be a backward step in Australia's efforts to meet its policy objectives across energy, waste and emissions.

But with the right incentives in place to level the playing field between landfill and resource recovery, Australia could establish a new market for EfW that diverts 13.7 million tonnes of waste from landfill each year by 2030. This has the potential to reduce emissions by up to 5.2 million tonnes of CO_2-e each year, which is the equivalent amount of emissions produced from 1.14 million cars each year.[10]

At a time of tightening budgets across every government, Australia needs bold ideas backed by private investment to support the economy and achieve long-term policy objectives. As a proven technology that governments can support immediately, EfW presents a compelling case for greater consideration.

RECOMMENDATIONS

Recommendation 1

Governments should define a role for Energy from Waste through their recycling and waste management plans and strategies. These documents should openly address energy recovery and the potential role it can play in improving waste management outcomes in Australia.

Recommendation 2

Governments of all levels should help to establish social licence for Energy from Waste – broadly and locally – by engaging communities openly on the benefits of advanced forms of waste processing and addressing any concerns.

Recommendation 3

Governments through the National Federation Reform Council (NFRC) should develop nationally consistent guidelines for the development of Energy from Waste projects and other waste management technologies.

Recommendation 4

Governments through NFRC should adopt EU emissions standards for Energy from Waste facilities, applied through nationally consistent regulation.

Recommendation 5

Governments through NFRC should seek to establish a national market for Energy from Waste, including nationally consistent regulations in relation to feedstock, and development of market opportunities for by-products.

OVERVIEW OF THE WASTE SECTOR

The waste sector

The Australian waste sector employs **50,000** people

The Australian waste sector generates **$15.5 billion** per year

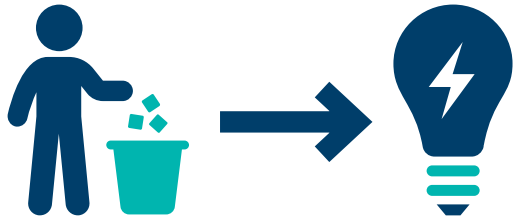
For every 10,000 tonnes of waste recycled **9.2 jobs** are created

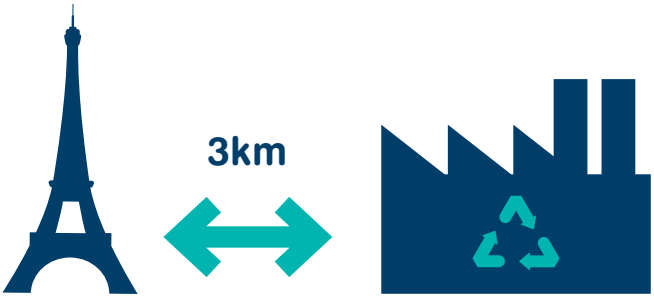
For every 10,000 tonnes of waste sent to landfill only **2.8 jobs** are created

Energy from Waste

Europe has over **500** EfW plants

Combined European EfW plants thermally treat over **90 million tonnes** of waste per year





Overseas EfW facilities operate safely in close proximity to populations

There are three EfW facilities within **three kilometres** of the Eiffel Tower and an EfW facility within **one kilometre** of the Danish Royal Palace

The global EfW market was valued at **US$25.32 billion** in 2013 (88.2% of which is thermal energy conversion)

The global EfW market is expected to grow to **US$40 billion** by 2023

Quantity of waste

Australia produces 67 million tonnes of waste (including ash) per year

32.7 million tonnes
is commercial and industrial waste

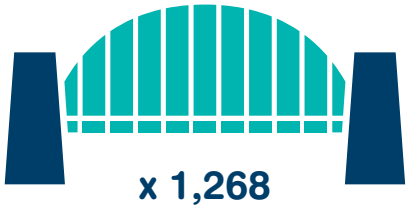
13.8 million tonnes
is municipal solid waste

20.4 million tonnes
is construction and demolition waste

Australia generates **1,268** times the weight of Sydney Harbour Bridge each year

This is enough to fill Sydney Harbour in **6.5 years**

This is enough to fill the MCG **52 times**



37 million tonnes or
55 per cent is recycled

27 million tonnes or
40 per cent is sent to landfill

If Sydney Harbour was a landfill, we would fill it in just **14 years**

This is **511 times** the weight of Sydney Harbour Bridge

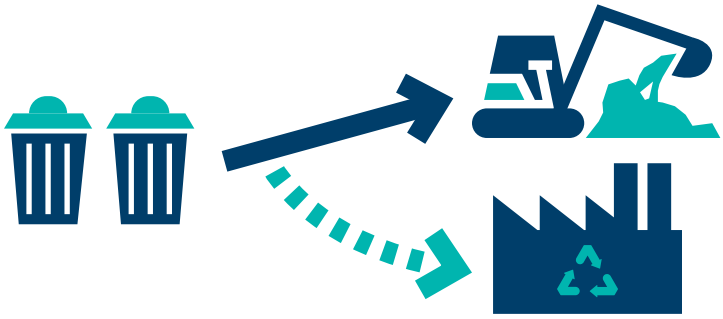
This is enough to fill the MCG **23 times**

The average Australian produces **2.2 tonnes** of core waste each year

That's enough for each person to fill a backyard swimming pool **every year**

Based on current trends core waste production will increase from **54 million tonnes** in 2016-17 to **61 million tonnes** by 2030

Energy from Waste potential



There will be **18.3 million tonnes** of residual waste going to landfill by 2030

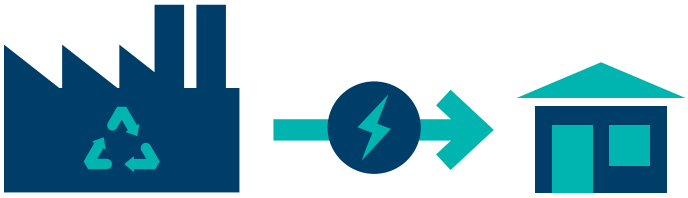
13.7 million tonnes of this residual waste could be diverted from landfill and used for EfW

Investment opportunity in EfW of **$8.2 billion** to **$13.7 billion** by 2030

3.8 to **5.2 million tonnes** of CO_2 could be avoided per year by 2030

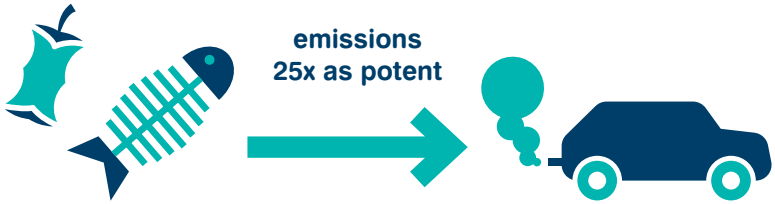
This is equivalent to taking **834,679** to **1.1 million** cars off the road

873 MW to **1,593 MW** of capacity from EfW by 2030, which is enough to power **1.4** to **2.6 million** households



Australia's biogas potential is equivalent to almost **9 per cent** of Australia's total energy consumption

When organic waste decomposes in landfill it produces methane which is **25 times** more potent than the CO_2 emitted from a car



1. AUSTRALIA HAS A GROWING WASTE PROBLEM

Quantifying Australia's waste problem

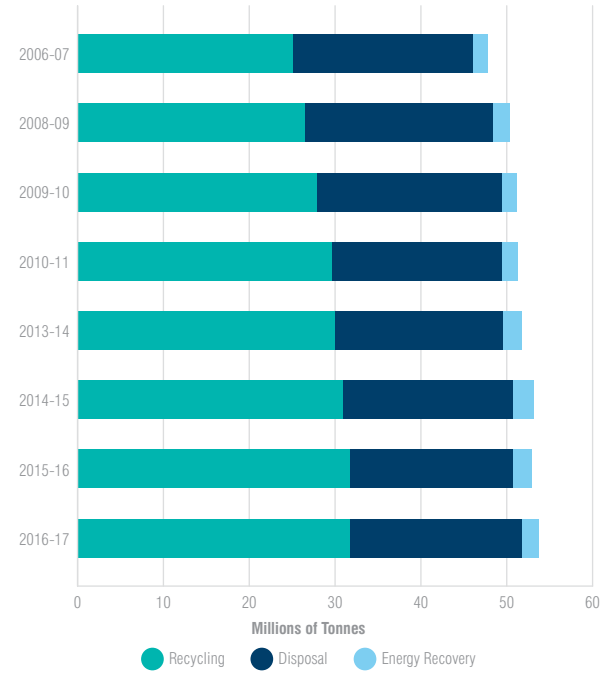
Australia produces around 54 million tonnes[11] of core waste per annum. Over the last decade, core waste production has increased by 1.16 per cent.[12] In 2016-17, Australians generated enough waste to fill the MCG every week or Sydney Harbour every 6.5 years. That is approximately 54 million tonnes[13] of core waste. Around 20 million tonnes of that waste is sent to landfill, with 32 million tonnes recycled, and a mere two million tonnes used for energy recovery.

The average Australian generates 2.23 tonnes of core waste every year, which is declining at the incremental rate of 0.5 per cent per year.[14] However, this is lower than the historical population growth rate. With the national population expected to grow to 30 million over the next decade, Australia's total core waste is set to increase to 61 million tonnes by 2030.[15]

Increasing waste volume is not the only problem. Australia's capacity to manage waste in an environmentally sustainable and cost-effective way is severely lacking. Where landfill disposal is the default option, waste becomes a cumulative issue as existing landfills reach capacity and land for new sites remains limited.

Figure 1 shows that waste generation has grown steadily from 2006-07 to 2016-17, with recycling and energy recovery gradually eroding landfill's share of waste management. Of our total core waste generated in 2016-17, around 32 million tonnes (58 per cent) is recycled and 2 million tonnes (four per cent) is used for energy recovery. The remaining 20 million tonnes (38 per cent) is disposed of in landfill.[16]

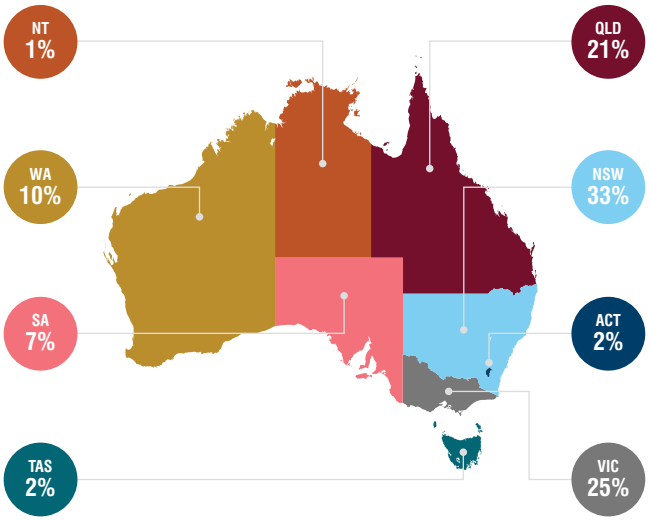
Figure 1: Waste management methods for Australia's core waste from 2006-07 to 2016-17



Source: National Waste Report, 2018

Figure 2 shows the percentage of waste generated by each state and territory in FY2016-17. New South Wales, Victoria and Queensland accounted for over three-quarters of total waste generated, which is broadly in line with these states' share of Australia's total population.

Figure 2: Core waste generation by state and territory in FY2016-17

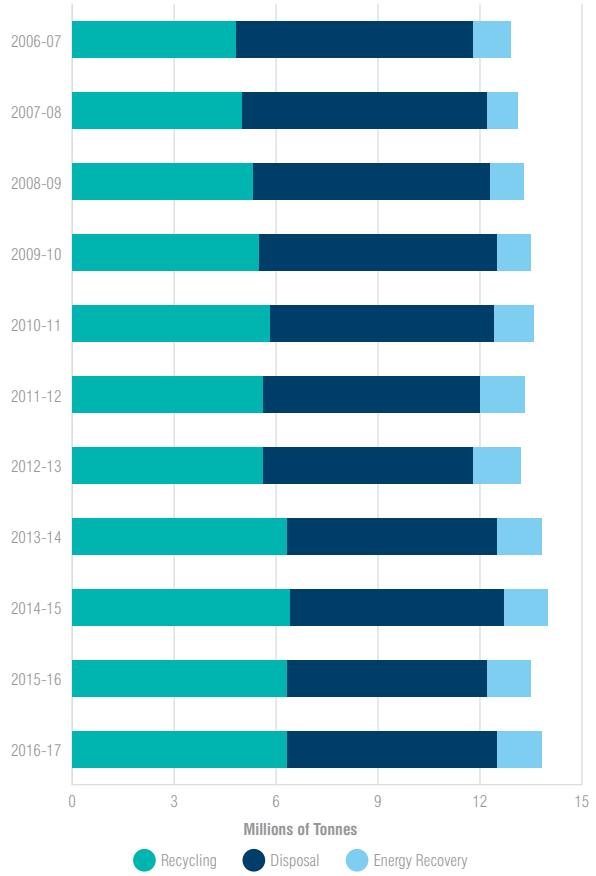


Source: National Waste Report, 2018

Australia's population distribution can also create challenges for waste management, with low population densities outside of major cities resulting in dispersed waste generation. In areas where waste volume is low, it is difficult for local councils to achieve the economies of scale required to make investments in advanced waste management practices.

Figure 3 shows the trend in treatment of municipal solid waste over a 10-year period from 2006-07 to 2016-17. The amount of core waste disposed of in landfill decreased by 11 per cent over the decade and the amount of core waste recycled increased by 26 per cent over the same period. Energy recovery has remained relatively consistent as a small proportion of municipal solid waste treatment across every state and territory.

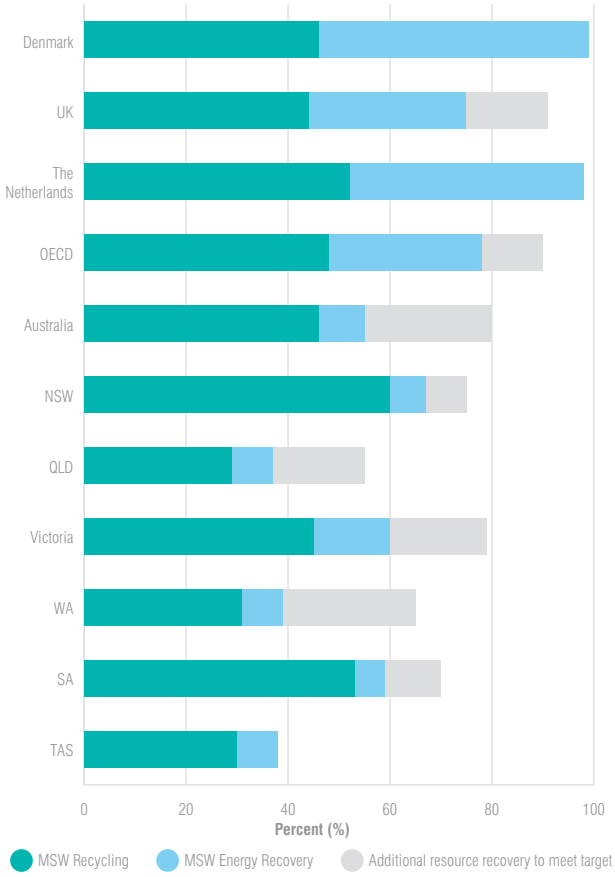
Figure 3: Australia's municipal solid waste management from 2006-07 to 2016-17



Source: National Waste Report, 2018

Australia has much lower rates of resource recovery than most other OECD countries. Figure 4 compares Australia's performance in resource recovery to that of several European countries and the OECD average. It also highlights the additional resource recovery needed for each jurisdiction to meet existing resource recovery targets.

Figure 4: Municipal solid waste resource recovery rates and targets



Source: National Waste Report, 2018

International waste import restrictions

Recent changes to foreign waste policy have impacted Australia's domestic waste market. For a long time, Australia relied heavily on China as an export market for recyclable waste. In 2017, China announced increased restrictions under the 'National Sword Policy'. China now only accepts recyclables that are 99.5 per cent uncontaminated.[17]

These restrictions have had a direct impact on our domestic waste market, as Australia currently lacks the infrastructure to collect and sort recyclables to meet China's waste standards. The National Sword Policy has not only impacted Australia's waste management industry, but other major trade-dependent nations worldwide.

The National Sword Policy affects 1.3 million tonnes (four per cent) of Australia's recyclable waste. This equates to approximately 36 per cent of all recyclable plastics and 29 per cent of all recyclable paper and cardboard produced in Australia.[18]

Prior to the restrictions, Australian recycling facilities received $225-$250 per tonne for paper and plastics sold to China.

The current price now sits at around $50 per tonne.[19] This significant reduction in export price has left many recycling facilities unprofitable.

Since China's policy changes, Vietnam, Malaysia, India and Indonesia have introduced similar restrictions on recyclables. As a result, self-sufficiency in waste management and resource recovery is becoming an increasingly important global objective.

Government responses provide a step in the right direction

Following China's initial restrictions, the Australian Government, with the support of states, territories and local governments agreed to a series of targets and actions at the Meeting of Environment Ministers on 27 April 2018.[20] Key commitments included:

- setting a target for 100 per cent of Australian packaging to be recyclable, compostable or reusable by 2025
- encouraging waste reduction strategies through greater consumer awareness, education and with industry leadership
- expanding and developing our recycling industry to grow our domestic capabilities
- advocating for increased use of recycled materials in the goods that government and industry purchase, and
- supporting the move to a circular economy in which waste is recycled into new products.

The 2018 *National waste policy*[21] identified waste management and resource recovery as priority issues. Despite this, the policy did not name the specific steps Australian governments and industry should take to address its waste challenges.

In recognition of some of the shortcomings of the 2018 Policy, the *National waste policy action plan*[22] was developed and released in late 2019. This report, supported by governments of all levels, put forward a number of national targets on resource recovery and recycling, as well as a commitment to ban the export of waste plastic, paper, glass and tyres from mid-2020. This plan was largely responsive to restrictions put in place by other countries, but it provides clarity to the domestic waste market on the scale of change required within a short timeframe.

Released in March 2020, the COAG response strategy to waste export bans[23] provides a number of further commitments by governments to address the nation's mounting waste management challenges.

It is encouraging to see Australian governments agree to:

- an 80 per cent resource recovery target for all waste streams by 2030
- consider a nationally coordinated approach to waste levies
- improve the quality of waste sector data, and
- find ways to boost scale for local governments waste management and resource recovery.

Waste management and circular economy strategies have also been released – either in draft or final form – over the past 12 months by the state governments in New South Wales,[24] Victoria,[25] (including a separate report by Infrastructure Victoria),[26] Queensland,[27] Western Australia[28] and Tasmania.[29]

These provide greater details about the steps that governments and industry need to take in each state to address their respective waste management challenges, contribute to national targets, and embed 'circular economy' principles in their policies and planning.

These strategies will help to close the gap between Australia and the global leaders in waste management, such the Netherlands, Germany and South Korea.[30] While the national resource recovery target of 80 per cent by 2030 falls short of the European Union's target of 90 per cent resource recovery by 2030, this is nonetheless a step in the right direction towards addressing the nation's mounting waste management challenges.

2. UNDERSTANDING ENERGY FROM WASTE

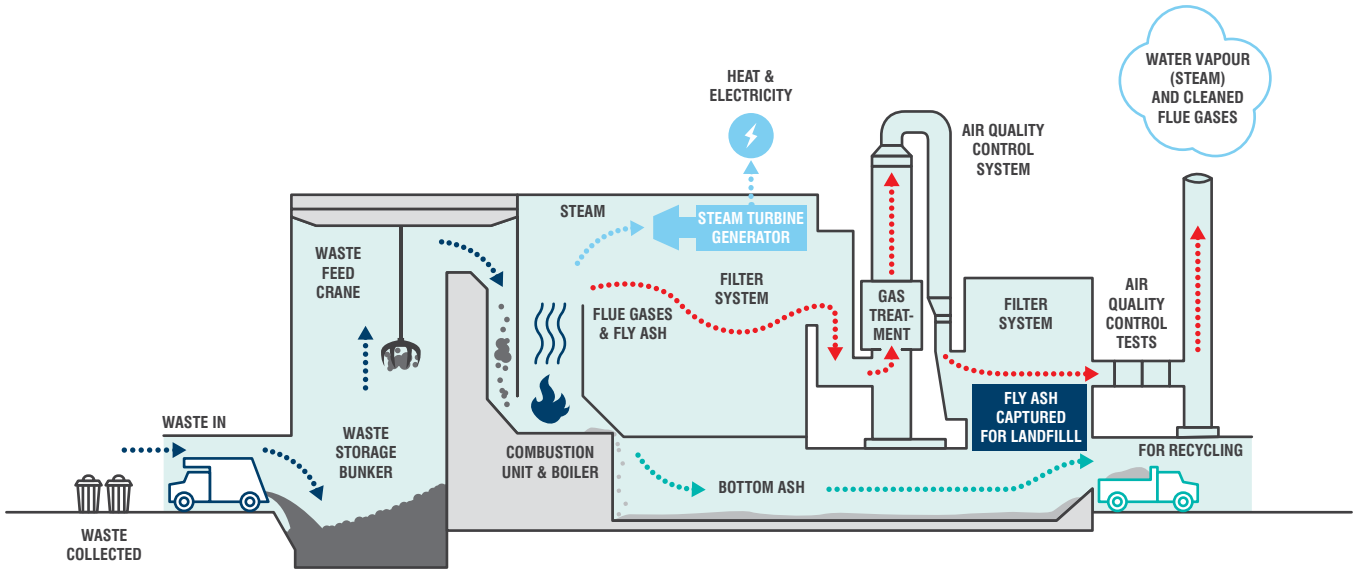
The process of turning waste into energy

The term EfW refers to the process of converting waste into energy, or an energy-carrying product, such as gas or oil. The various EfW technologies have similar benefits, which include:

- reducing the volume of waste and hence the volume requiring disposal in landfill
- reducing the biodegradable fraction of waste to zero, and
- producing a useful commodity, such as electricity, heat and/or fuel from non-recyclable waste.[31]

EfW combustion technology recovers energy from residual waste streams and produces other useful by-products. The process involves combusting waste to generate steam, which powers steam turbogenerators that produce electricity and potentially also heat to be used in homes, businesses and by industry (Figure 5).

Figure 5: The thermal Energy from Waste process



Source: Australian Paper, 2018

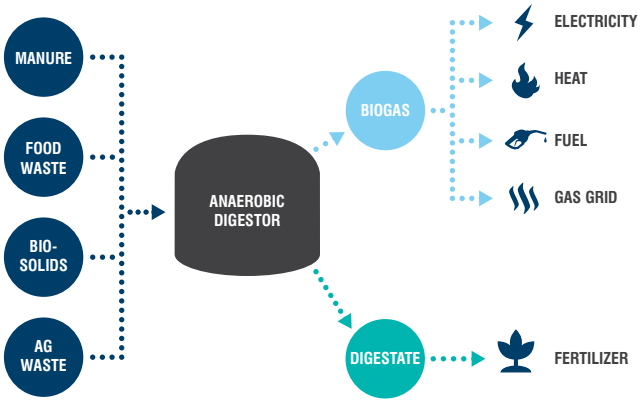
Waste is transported to the EfW facility and combusted in a boiler. The boiler produces heat, which in turn produces steam. Gases from the combustion process are treated to very high specifications, through gas treatment and filter bags, making the gases safe to discharge.

The cleaned combustion gases are released through the stack, while being continuously monitored. During the process, metals are recovered, and by-products can be further processed for use as road base or in other construction materials.

EfW facilities are required to manage residues such as bottom ash and Air Pollution Control Residues (APCR). Bottom ash is an inert by-product that can be reused, whereas APCR is generally managed through hazardous waste disposal.

A second form of EfW technology is biological EfW. This process recovers energy from organic matter, including food waste. Energy is produced in the form of biogas, with the process occurring in the absence of oxygen within an anaerobic digester. It also produces digestate as a by-product, which can be used as fertiliser for agricultural purposes (Figure 6).

Figure 6: The biological Energy from Waste process



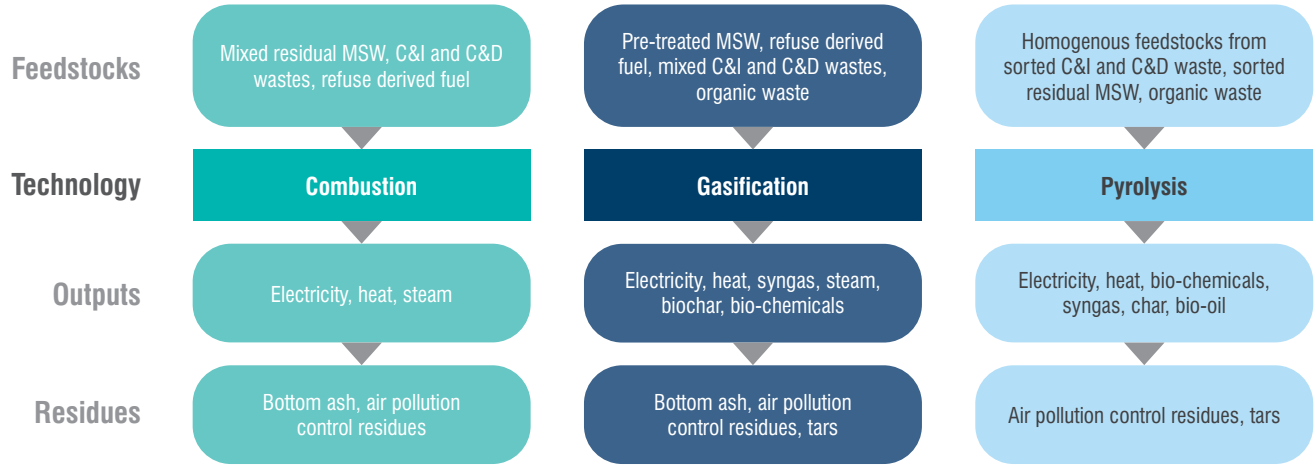
Source: The Renewable Energy Hub, 2018

Types of Energy from Waste technologies

There are a range of sophisticated resource recovery technologies designed to extract the most value from our waste. EfW is at the forefront of the transition from traditional waste management to resource recovery, with hundreds of facilities in use throughout Europe, North America and Asia.

There are two main types of EfW technologies – thermal treatments including combustion, gasification and pyrolysis (Figure 7), and the biological processing of organic waste (Figure 8).[32]

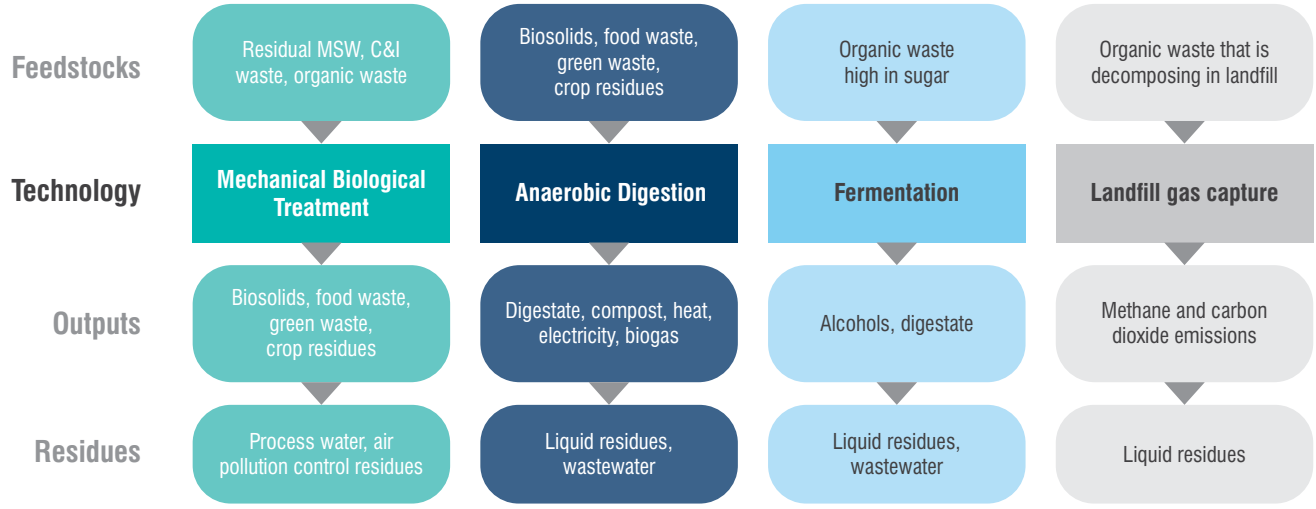
Figure 7: Thermal Energy from Waste technologies



Source: Victorian Department of Environment, Land, Water and Planning, 2017

A large-scale EfW facility is likely to use combustion technology to process mixed waste streams such as municipal solid waste. Advanced thermal technologies, including gasification and pyrolysis, require homogenous and uncontaminated feedstock to operate efficiently. Organic waste material with high moisture content is generally suited to biological processes such as anaerobic digestion and other small-scale operations.

Figure 8: Biological Energy from Waste technologies



Source: Victorian Department of Environment, Land, Water and Planning, 2017

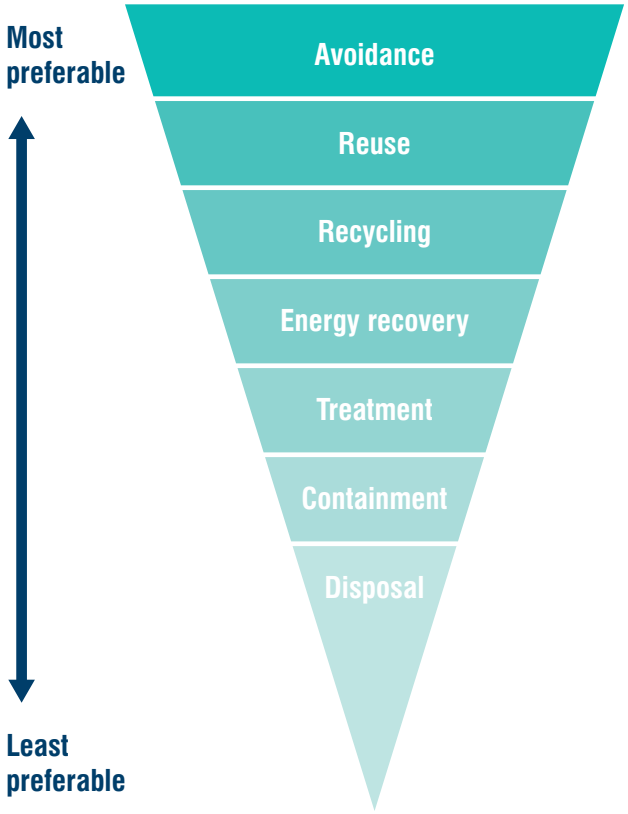
Common forms of energy outputs include heat, steam, biogas, synthetic gas or oil, many of which can be turned into other, easily transportable forms of energy such as electricity. The conversion process also produces different types of compounds for treatment or reuse.

Energy recovery has a role within best practice waste management

To effectively manage Australia's waste, all available options should be considered. Where waste generation cannot be avoided and recyclable materials have been removed from the waste stream, EfW is the most sustainable option for treating the remaining residual waste.

As shown in Figure 9, separating out materials for reuse and recycling should be prioritised. Similarly, energy recovery is the preferred method for treating residual, combustible material compared to disposal (landfill).

Figure 9: Energy recovery in the waste management hierarchy



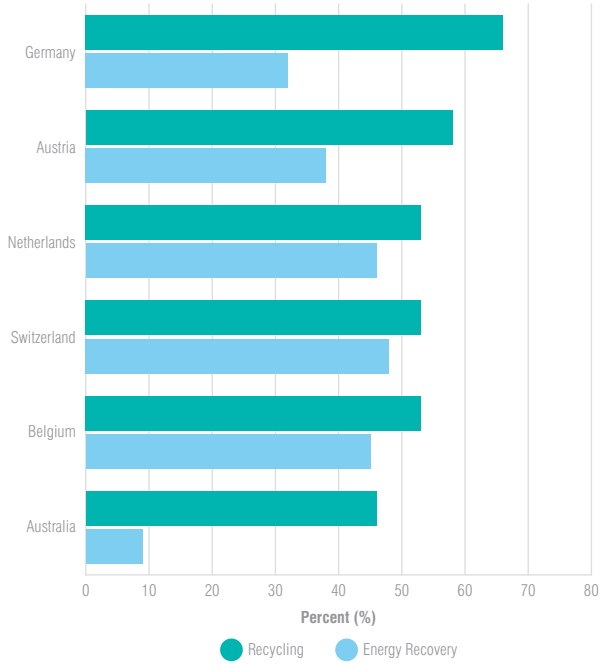
Source: Victorian Department of Environment, Land, Water and Planning, 2017

Over time, the limitations on re-use and recycling will change as technology advances. Similarly, improvements in packaging design will see a greater proportion of waste available for recycling. Both scenarios will impact the amount of residual waste available for energy recovery, so policymakers must ensure that long-term waste management planning is flexible enough to accommodate expected changes to the types of waste generated.

Recycling and energy recovery are not mutually exclusive

European countries that have embraced EfW have successfully managed the balance between recycling and energy recovery. Figure 10 compares the proportion of municipal solid waste that is recycled and used for energy recovery as part of the waste management cycle between Australia and several European nations. It shows that Australia could dramatically expand EfW capacity without undermining recycling efforts.

Figure 10: Municipal Solid Waste recycling and energy recovery rates



Source: National Waste Report, 2018

In order to prevent the use of recyclable waste as feedstock for EfW facilities, policymakers can pursue initiatives to improve the separation of waste at the source, as well as introduce mandatory feedstock rules, for example in the form of eligible feedstock guidelines, which are drafted on the basis of the waste management hierarchy. Further, state governments should seek to embed these regulatory guidelines for EfW feedstock into statutory licence instruments.[33]

For example, the Victorian Environmental Protection Agency may impose conditions upon EPA approvals to conduct EfW operations, requiring feedstocks to only be comprised of landfill waste and prohibiting the use of recyclable materials in feedstock supply. With these types of assurances in place, EfW can play a complementary role in resource recovery, whereby it processes residual waste only.

The benefits of Energy from Waste

Less pollution compared to landfill

The cumulative environmental, social and economic costs of landfill are significant, leading to a range of problems including:

- reduced public amenity due to odours and unsightliness
- toxins such as mercury, arsenic, cadmium, solvents, acids and lead seeping into surrounding soil and groundwater
- creation of leachate as water filters through decomposing waste, polluting surrounding land, groundwater and waterways, and
- release of greenhouse gas emissions such as methane, which is generated through the anaerobic decomposition of organic waste.[34]

Well managed landfills employ technologies to capture methane emissions, which is used to generate renewable energy. EfW can produce fewer greenhouse gas emissions than if waste is disposed of in landfill. While burning feedstock through EfW may produce other forms of emissions, these can be controlled at source and managed by air quality regulations – as discussed further in the next chapter.

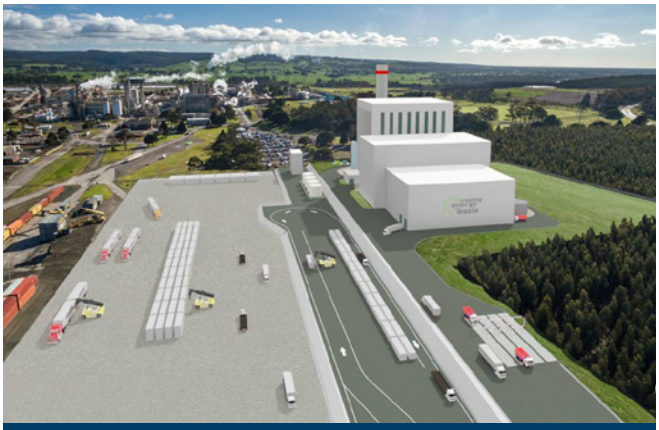
The potential impact of methane, produced by organic waste decomposing in landfill, is 25 times greater than CO_2-e over a 100-year period.[35] Modelling by ACIL Allen for Infrastructure Partnerships Australia estimates that EfW has the potential to avoid 3.8 to 5.2 million tonnes of CO_2-e every year by 2030.[36] This is the equivalent amount of emissions produced by up to 1.14 million cars each year.[37]

Reliable source of renewable energy

EfW is a renewable energy source when the feedstock is produced using natural resources that are consistently replenished and non-finite. The Clean Energy Regulator identifies waste as a renewable source of energy if it meets one of the following categories:

- wood waste
- agricultural waste
- food waste and food processing waste
- biomass-based components of municipal solid waste, and
- biomass-based components of sewage.[38]

EfW is a relatively stable domestic fuel source. It can provide a reliable source of baseload power that complements other intermittent types of renewable energy, diversifying the energy mix as Australia transitions to a lower-carbon energy system.



Source: Australian Paper

Case Study 2: Australian Paper Energy from Waste facility

Australian Paper, located in the Latrobe Valley, has proposed a 225-megawatt thermal EfW facility in partnership with SUEZ. Australian Paper is the largest industrial user of natural gas and coal-fired electricity in Victoria, making it significantly exposed to surges in energy prices and uncertainty of supply.

The proposed $600 million facility will have the capacity to process up to 650,000 tonnes of municipal solid waste (80 per cent) and commercial and industrial waste (20 per cent). This is expected to reduce capacity pressures on existing landfill sites in Gippsland and Melbourne.

The EfW facility will provide an alternative baseload energy source for Australian Paper's Maryvale Mill, through the production of steam and electricity. The facility will interchange between the two outputs during operation, providing improved flexibility and efficiency.

Australian Paper estimates that 96 per cent of waste material received will be used as energy or repurposed for road and building products, leaving only four per cent for landfill disposal. Excess electricity generated will be sent to the grid, increasing supply in the electricity market.

The project has been granted a works approval by the Victorian Environmental Protection Authority. Construction is expected to begin in 2022, with the facility due to open in 2025.[39]

Localised waste management solution

The transportation of waste can lead to traffic congestion, increased carbon emissions, and potential waste spillages.[40] Effective waste management strategies should consider the proximity principle, which recommends waste be managed close to the point of generation to minimise the costs of transportation.

EfW facilities can provide localised waste management solutions in order to meet the proximity principle. Local treatment of waste can assist in overcoming other challenges, such as minimising unpleasant odours in densely populated public spaces, improving overall amenity.

Source: Fed Square

Case Study 3: Federation Square anaerobic digestion facility

Federation Square in Melbourne's CBD operates an anaerobic digestion facility, treating up to 800 kilograms of waste each day.

Organic waste, such as food scraps from the precinct's restaurants and vegetation from Federation Square's rooftop gardens is collected and processed onsite. The fully automated system first macerates the waste before transferring it to a reactor where the sugars and carbohydrates are converted into acetic acid, before then being converted into biogas. The biogas is then fed to a boiler, which is used to produce heat and hot water for the building. Digested solids – a by-product of the process – are collected to be used for gardens and composting.

This process of anaerobic digestion can produce up to 14,400 litres of gas per day. It also avoids the emission of greenhouse gases from the waste if it was instead transferred to landfill.[41]

3. ESTABLISHING A ROLE FOR ENERGY FROM WASTE

Setting a clear role for Energy from Waste in Australia

Despite the number of government plans and strategies regarding waste, recycling and circular economy that have been recently released, as detailed in Chapter 1, energy recovery remains a relatively taboo topic in many official documents – often with little more than euphemistic commentary.

Many of these reports briefly mention the potential role of energy recovery, but provide little detail on the scale of that role or the steps required to develop Energy from Waste or other advanced processing facilities, including the required changes to regulatory and planning settings and establishment of social licence required to enable their development.

In particular, the 2018 *National waste policy*[42] and the 2019 *National waste policy action plan*[43] provided no advice on the role energy recovery could play as part of Australia's waste management solution. A COAG response strategy to the waste export bans[44] called for all governments to, *"provide longer term certainty in waste to energy policy to help businesses make investment decisions,"* but gave no further detail or instructions about the actions required to achieve this.

The exception among state-based plans has been provided by the Victorian Government. Both *Recycling Victoria*,[45] released by the government in February 2020, and Infrastructure Victoria's *Advice on recycling and resource recovery infrastructure*,[46] released in May 2020, provide discussion on the potential role of Energy from Waste within the broader waste solution. This will assist with the development of new Energy from Waste or other advanced processing facilities in the state, including those being considered in South-East Melbourne – with procurement underway at the time of publishing. More information is included in Case Study 4.

Recommendation 1

Governments should define a role for Energy from Waste through their recycling and waste management plans and strategies. These documents should openly address energy recovery and the potential role it can play in improving waste management outcomes in Australia.

Case Study 4: Melbourne Metropolitan Waste and Resource Recovery Group

The Metropolitan Waste and Resource Recovery Group (MWRRG) was established as a Statutory Body of the Victorian State Government on 1 August 2014. The MWRRG coordinates waste management and resource recovery across the 31 local councils that make up metropolitan Melbourne. The organisation procures and manages multi-council contracts for waste management facilities and waste and resource recovery services.

By combining waste management and resource recovery responsibilities, the MWRRG can use its scale to better plan for and provide a range of services than councils could achieve individually. The multi-council contracts used by the MWRRG have large benefits in terms of procurement, such as the ability to secure long-term service contracts at a lower cost to councils and combining waste quantities to attract more advanced technology solutions across the supply chain.[47]

In March 2020, the MWRRG called for Expressions of Interest to provide 'advanced waste processing' services for residual municipal solid waste for a group of 16 municipal councils in Melbourne's south-east over a period of 20 to 25 years. Bidders were required to propose a technology solution for managing waste, which may include one or more EfW facilities. The MWRRG anticipates that the procurement process will take up to two years, with the contract awarded in 2022 and construction of new facilities to commence in 2023.[48]

Establishing a social licence for Energy from Waste

A persistent failure by some governments to openly address energy recovery is likely due to concerns that Energy from Waste holds some political sensitivities. A broad social licence has not yet been established for the technology in many parts of the country, making the development of new facilities challenging. Indeed, in the absence of a broader strategic case, social licence for EfW must be prosecuted in whole for each and every facility.

A waste, recycling or circular economy strategy that fails to discuss a role for energy recovery presents additional hurdles for the development of EfW facilities by placing a burden on the proponents of individual facilities to both inform the public about the technology and build support for their proposal.

Overcoming social licence challenges requires public discussion of energy recovery, its benefits and risks, and an opportunity to engage the community on the issues surrounding the development of Energy from Waste facilities. This should be achieved on a broad basis – through state-wide or national plans and strategies – and at a local level through planning and engagement tools. Social licence for energy recovery is much harder to establish without a level of community understanding and engagement.

Governments are better placed and resourced than industry participants to issue support for the sector and provide a forum for public discussion about benefits and concerns. Similarly, any regulatory or policy changes required to facilitate energy recovery can and should be openly addressed at a state or territory level, rather than requiring negotiation through individual projects. These changes can take time, and add considerable costs and risks to the proponents of individual facilities.

Through engagement, it is important for governments and industry to be transparent with communities about potential sites for Energy from Waste. Community concerns should be addressed openly, with continuing engagement on potential projects as they are planned, developed and constructed.

The New South Wales Government has taken steps to address social licence, planning and regulatory issues on a localised level, as detailed in Case Study 5.

Recommendation 2

Governments of all levels should help to establish social licence for Energy from Waste – broadly and locally – by engaging communities openly on the benefits of advanced forms of waste processing and addressing any concerns.

Case Study 5: Building community support for an EfW facility in Parkes

A precinct being planned in Parkes, in the Central West region of New South Wales, shows how state and local governments can work together to actively engage the community on future developments, and help to establish a social licence for a potential EfW facility.

Parkes is the planned home for NSW's first 'Special Activation Precinct.' This planning approach aligns with the state government's *20-Year economic vision for regional NSW*,[49] as a way of fast-tracking developments and investment in specified regional locations. Elements of the precincts, including potential public infrastructure investments, will be funded as part of the NSW Government's $4.2 billion Snowy Hydro Legacy Fund.

The planned precinct in Parkes is approximately 4,800 hectares. Its location seeks to take advantage of the Inland Rail project to provide a major freight and logistics hub, providing opportunities for businesses in Parkes and across the region with a faster and more reliable connection with global markets.

Planning for the Parkes precinct began in 2018, with a series of public consultation processes through 2019. Successive planning documents, including a Draft Master Plan,[50] Draft Structure Plan[51] and Community Statement,[52] have identified and planned a resource recovery precinct within the broader development. This includes signalling the potential for an Energy from Waste facility on the site. A range of consultation was undertaken, including councillor briefings, business briefings, community pop-ups, factsheets, radio and social media

Openly addressing the potential role of EfW early in the planning process enabled the local and state governments to engage with the community on the benefits this would bring. Governments were also able to address community concerns and articulate how these would be mitigated before specific developments were proposed.

By effectively front-loading community engagement, governments have made an important head-start on establishing a social licence for EfW in Parkes. This means project proposals can be fast-tracked through approval processes, providing confidence to private proponents of any EfW facility and other potential businesses in the precinct that investment and construction can proceed without unnecessary delay.

Following the release of a final Master Plan for the Parkes precinct, market sounding and development of an Expression of Interest process for the potential EfW facility is expected to proceed.

Setting clear and consistent rules for energy recovery technologies

Successfully embedding an appropriate role for EfW or other forms of energy recovery in Australia requires governments to provide greater clarity to the industry on the role of the technologies, and confidence through policies and regulations that take a long-term view. A lack of clarity could deter investment in the emerging sector, resulting in poorer waste management outcomes, or result in delays and inefficiencies that will ultimately add to costs for industry and taxpayers.

EfW and other forms of advanced processing infrastructure typically involve large-scale assets with complex arrangements to underpin the commercial viability of facilities. In order to attract finance, projects may require a set of agreements to be in place, including waste supply agreements to ensure sufficient feedstock for facilities, as well as agreements for the supply of energy, heat or by-products. EfW project developers generally enter into contracts with energy retailers or large energy consumers for some or all of the generation capacity.

Co-locating EfW facilities in areas where energy demand can improve the viability of EfW facilities by securing a buyer, while also providing industrial users with an inexpensive source of energy. To fast-track planning and zoning approvals, governments could consider establishing pre-approved zones for EfW facilities.

In Europe, a significant revenue stream for EfW facilities is through heat offtake agreements. For example, Sweden's EfW facilities provide district heating to municipal areas in major cities. Given Australia's climate, EfW facilities would find it difficult to establish a market for commercial heating, but district cooling through heat supplied to absorption chillers could be a possible application.

Heat supply from an EfW facility to an industrial user requires the user to be in proximity or co-located on-site to avoid expensive heat transmission piping. The ability for EfW facilities to secure energy offtake agreements is also supported by greater access and speed in connecting to grid infrastructure. For this to occur, planning should ensure co-location of facilities where possible.

EfW project development is subject to heightened planning restrictions, including minimum buffer zones between proposed facilities and residential areas. To support the development of EfW facilities, governments should offer clear guidance on planning and zoning requirements, providing transparency for both industry and the community.

Many planning controls and legislation are set and overseen by state, territory and local governments, so will be necessarily different across the country. However, governments should seek to provide consistency around core principles where possible, drawing from national targets and strategies for guidance. In 2013, the Western Australian Government set principles that have underpinned the development of new EfW facilities in that state (see Case Study 6).

Case Study 6: Western Australia's waste to energy position statement

In 2013, Western Australia's Waste Authority released a *Waste to energy position statement*.[53] The position statement makes several recommendations regarding appropriate sites for EfW facilities, providing industry with clarity around planning regulation, while also recognising the importance of flexibility in assessing options for individual projects.

The position statement recommends that EfW facilities should:

- be in current or future industrial zoned areas
- have adequate buffer distances to sensitive receptors over the life of the facility, and
- be close to the source of waste generation to reduce the impact of waste transportation.

For project proponents, consistency between the approaches of different jurisdictions reduces barriers to entry, helps to build scale and expertise in Australia, and lowers the costs and administrative burden of developing projects across the country. Consistency of policy and regulatory settings can help to boost competition in the market, which will lead to better value for money and allow them to tap into broader domestic and international expertise.

Governments should also consider the approach to procurement and contracting that will deliver best outcomes – not just in terms of value for money, but also alignment with the government's policy objectives. A range of approaches, including availability PPP models or regulatory asset base models, could be considered alongside traditional forms of procurement. Procuring agencies should design processes to harness the innovation, expertise and scale of private operators and investors, and draw from the experience of successful projects in other countries.

Recommendation 3

Governments through NFRC should develop nationally consistent guidelines for the development of Energy from Waste projects and other waste management technologies.

Adopting EU emissions standards

Emissions standards are a key component of the regulatory framework for EfW facilities. In the European Union, there are currently over 450 EfW facilities in operation. Emissions are tightly regulated through the EU Industrial Emissions Directive (IED).

Research by the World Energy Council found that combustion facilities are not a significant source of emissions where the IED has been applied, with dioxin emissions reduced by 99.9 per cent.[54] Noting that Victoria and Western Australia have already implemented the EU standards, adoption across all states and territories should be applied through nationally consistent regulation.

The IED's objectives are to minimise impact on the environment and human health from the resulting emissions to air, soil, surface and ground water. The key requirements in the IED[55] for the operation of an EfW facility are:

- a minimum combustion temperature
- emission limits for various toxins, and
- a maximum level of unburnt organics in bottom ash.

Under the IED, EfW facility exhaust stacks are equipped with Continuous Emission Monitoring Systems (CEMS). If any component of the CEMS equipment fails, the facility must cease operation immediately. Emissions data is also required to be publicly reported to maintain transparency regarding the safety of EfW facilities.

Management of emissions from EfW facilities is closely tied to their social licence to operate. A frequent concern from members of the community regards the emissions from EfW, so providing transparent regulatory settings can help to establish safeguards concerning the environmental and health impacts of EfW facilities.

Countries like Sweden, Japan and France have developed large-scale EfW facilities in the centre of densely populated metropolitan areas – as illustrated in Case Study 7. When combined with strict emissions controls, these projects have enhanced public awareness and community support for EfW technologies. It is important that proponents of EfW in Australia consider the suitability of scale and type of facilities in relation to the surrounding community.

Recommendation 4

Governments through NFRC should develop nationally consistent guidelines for the development of Energy from Waste projects and other waste management technologies.

Source: Bjarke Ingels Group

Case Study 7: Denmark's Copenhill Energy from Waste facility

Located in an industrial area just outside the centre of Copenhagen, Copenhill is an EfW facility that features a 600-metre recreational downhill ski run on its roof. Once fully completed, it will also feature hiking trails that wind up the roof at various inclines, and an 80-metre climbing wall.

The incorporation of recreational features in the design of the EfW facility assisted in building community support for the project. The facility not only meets the energy needs of the surrounding area, but also offers a unique experience for the local community.

Designed by Bjarke Ingels Group, construction on the DKK3.5 billion (AU$663 million) project began in 2013. The facility opened in 2017 and processes the non-recyclable waste of 550,000 households and 45,000 businesses.

The facility is capable of burning 25 to 35 tonnes of waste per hour, producing enough energy to power and heat roughly 150,000 homes. It is one of the cleanest and most technologically advanced facilities of its kind and is a key component in Copenhagen's goal to become the world's first carbon-neutral capital by 2025.[56]

Developing market opportunities for by-products

EfW facilities produce a variety of by-products at the end of the energy recovery process. These by-products can either be disposed of in landfill or sold for reuse. Where waste levies exist, disposing of by-products in landfill increases a facility's operating costs. However, if by-products are sold for reuse, they can become an additional source of revenue – as illustrated in Case Study 8.

By-products can be on-sold for use as road base or in other construction activities. Given the scale of infrastructure investment being undertaken – particularly on Australia's east coast – there are significant market development opportunities for these by-products.

Australian governments should address the initial steps in establishing a viable market for by-products, including:

- market development research
- product testing
- development of product standards
- creating supportive regulatory settings, and
- clarifying government procurement processes.

When developing a market for by-products, policymakers should seek guidance on policy and regulation already in place in overseas markets. Governments should ensure that by-products are only used when cost-effective, and exercise caution not to mandate the use of higher cost materials unless necessary.

Recommendation 5

Governments through NFRC should seek to establish a national market for Energy from Waste, including nationally consistent regulations in relation to feedstock, and development of market opportunities for by-products.

Source: Blue Phoenix

Case Study 8: Blue Phoenix bottom ash facility

Blue Phoenix UK is a leading European producer of incinerator bottom ash aggregate (IBAA). The facility processes bottom ash to recover any residual metals, which are sent to metals companies for reuse.

All of the residual bottom ash is able to be diverted from landfill. Through the recovery process, the facility effectively recycles 20 per cent by mass of the original waste tonnage.

IBAA is a cost-effective material with logistical advantages due to the low density, allowing for fewer vehicle movements compared to primary materials.[57]

4. NEXT STEPS

Developing a role for Energy from Waste in Australia

Clearly, Energy from Waste can – and should – play a greater role in the management of Australia's waste. The introduction of a national waste export ban provides the impetus for change, with a clear need to rethink how we manage our waste, extract value from it, and use it to achieve broader objectives, such as emission reductions.

Unlike other forms of energy and waste technologies, the technical or strategic case for EfW does not need to be proven. EfW has proven to be an effective form of waste management and energy generation in countries around the world over recent decades. Australian governments should look to the success of EfW in these countries, and leverage the expertise of industry proponents that have built considerable experience developing, operating and investing in EfW projects in these international markets.

But Energy from Waste faces obstacles to development that other forms of technology do not. A lack of large-scale thermal EfW facilities in Australia means that community understanding of the benefits and risks is relatively low. Establishing a broad social licence for EfW and putting in place nationally consistent rules are essential steps to support the development of facilities across the country and embedding EfW efficiently in the waste and energy sectors.

Governments and industry need to work together

Despite many years of stagnation around waste management, and an unwillingness to openly declare technologies such as EfW as part of the solution, Australia's governments appear to finally be heading in the right direction.

The various strategies and plans released by governments over recent years addressing waste issues and establishing circular economy principles are a good start. A circular economy provides the right framework for considering approaches such as EfW, including the benefits and challenges it brings. The next step for governments is to clearly articulate the role EfW can play within the circular economy each seeks to create.

Industry must be prepared to work with governments to develop facilities that support their stated public policy objectives. Transparency and a willingness to engage with communities on any concerns they hold will be important to establishing and maintaining a social licence for EfW.

Building on this paper, Infrastructure Partnerships Australia will continue to make the case for a greater role for EfW in Australia's energy and waste sectors.

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