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Issue 43 August 2019



Real Assets Research Trip

Waste-to-Energy Infrastructure

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Frontier regularly conducts international research trips to observe and understand more about international trends and to meet and evaluate, first hand, a range of fund managers and products.

In conjunction with insights we share with our Global Investment Research Alliance partners, these observations feed into our extensive international research library.

This report provides a high-level assessment on the key areas and observations unearthed during this recent Real Assets research trip. We would be pleased to meet with you in person to provide further detail on these observations.

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Introduction

Frontier recently visited the US and evaluated the state, acceptance and economics of waste management facilities, such as waste-to-energy plants.

Waste-to-energy is a niche infrastructure investment segment, which is accepted and well-established in the US and Europe, but one that is likely to gain further prominence in Australia and other parts of the world, in the midst of a global waste management crisis. In mid-2017, China notified the World Trade Organisation that it planned to restrict imports of 24 types of waste (primarily plastics and waste paper) from 1 January, 2018 (termed China's Green Sword), triggering a waste management crisis across the world.

We believe the US experience of processing waste and extracting value provides a valuable blueprint for dealing with waste disposal in Australia, particularly when recyclable material that was previously exported to Asia will now need to be processed on-shore. Hence, the need for investment is particularly urgent given the existing 27 megatonne gap (42% of all waste) in Australia's capacity to recycle or recover embodied Energy from Waste¹.

Australia has, historically, lacked a sustainable strategy for handling recycled waste (aside from exporting to Asia). However, the imperative to adopt a robust Waste-to-Energy (WtE) processing strategy/policy could not be stronger in the current climate, and significant investment in waste management infrastructure will be required.

In doing so, Australia needs to think through the way waste management infrastructure investment should be structured and the role for private sector investment. In the US, WtE has long been an accepted sector with private capital participation and this could provide some useful precedents for Australia.



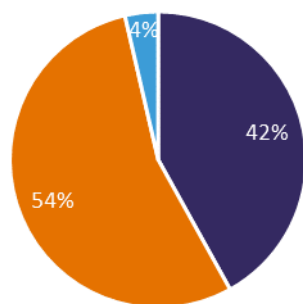
¹Senate Environment and Communications References Committee - Never waste a crisis: the waste and recycling industry in Australia

Waste management—the background

Waste production is inextricably linked to the rise and fall in GDP and population growth; as the economy grows, consumption and production increases, leading to an increase in waste production.

Norway and Denmark are the world leaders in WtE, with 500-700 kg of waste per capita per annum converted to energy. In comparison, around 100 kg of waste per capita per annum is converted to energy in the US, while in Australia, this figure is 8 kg. Presently, there are no large-scale energy from waste facilities operating in Australia.

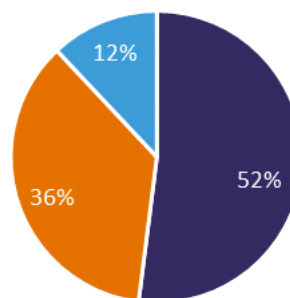
Chart 1: Australian waste processing



■ Landfill ■ Recycling ■ Energy recovery

Source: ABS

Chart 2: US waste processing



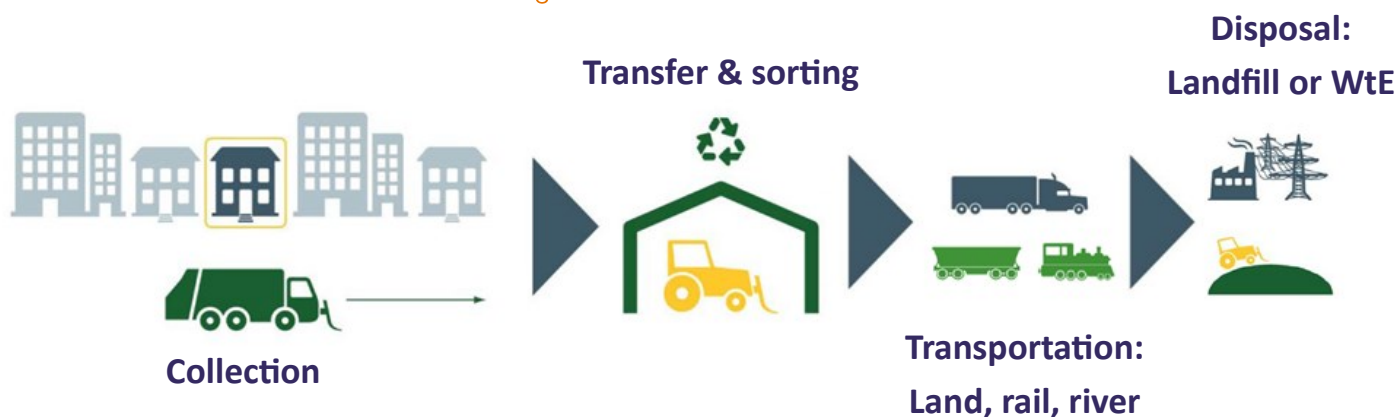
■ Landfill ■ Recycling ■ Energy recovery

Source: EPA

The waste value chain

The waste management sector itself is not a cohesive single industry but consists of a range of industries with multiple functions (waste collection, transfer, sorting, recycling/recapture/disposal).

Figure 1: The waste value chain



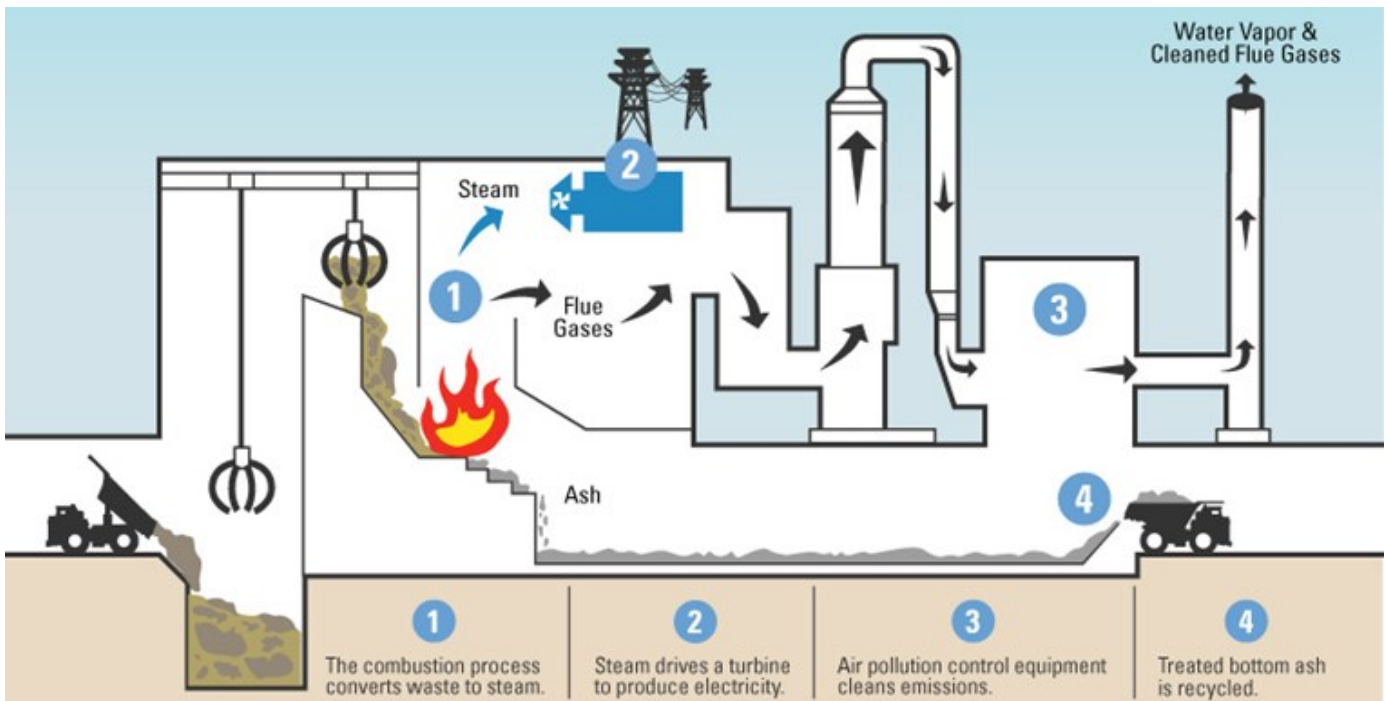
Source: National Waste Report

How does waste-to-energy work?

WtE is the process of creating energy in the form of electricity and/or heat (steam) from the incineration of waste. Residual waste is fed into a combustion chamber and burned at a high temperature to boil water and create steam. The steam turns a turbine-driven generator to produce electricity, or may be used directly for industrial processes.

Emissions and other operating criteria are monitored to ensure compliance with environmental standards. Residual materials are collected for processing and metal extraction, and unused materials, such as fly ash, can be further re-used for road construction, for example, or disposed of in landfill.

Figure 2: Waste-to-energy process



Source: Asian Development Bank

Infrastructure characteristics of WtE

WtE plants represent hard assets that complete the waste value chain. They have high barriers to entry due to planning, permitting, environmental restrictions as well as input feed constraints, and cannot be easily substituted once constructed. Community and government efforts to reduce landfill usage also favour WtE fundamentals. WtE facilities' revenue profile is underpinned by long-term, inflation-linked waste contracts. Moreover, WtE assets are generally 'recession resilient', with waste volumes declining by only c.2-3% during times of recession based on historical data.

Most viable WtE assets are located near i) densely populated regions: to ensure regular feedstock (waste) supply, and ii) a water source: lakes, rivers or sea for a steady water supply.

Energy created through the WtE is considered renewable, since emissions from WtE plants are processed and controlled to meet acceptable environmental guidelines and are generally lower than those that would have been released had the waste travelled to and occupied a landfill. In addition, WtE provides baseload power (24/7 energy production), which is important for grid stability with an increase in sources of intermittent generation (e.g. solar/wind).

The revenue profile for a WtE facility comprises disposal charges (gate/tipping fees) for accepting certain types of waste that would otherwise go to landfill. This revenue stream can account for c.60-80% of total revenue (US data based on average landfill disposal prices/tonne). Final waste volumes are reduced by 80-90% relative to landfill volumes, by diverting to WtE facilities. Sale of electricity and excess steam can account for the remaining c.20-40% of total revenue. Recycling of recovered metals from the incineration process can also add another revenue stream and reduce the need for the production of new metals, further helping reduce emissions.

Why waste-to-energy?

There are considerable public benefits arising from investments in waste recovery infrastructure such as WtE plants. These include avoided landfill usage, reduction in the use of virgin materials, production of baseload renewable energy and economic development for the community.

Table 1: Drivers and barriers of WtE

Drivers	Barriers
Increasing costs of landfill prices, including through the landfill levy, provide incentives for waste collectors to divert to resource	New technologies, relatively untested in the Australian context
Decreasing availability of landfill space in CBDs and surrounding regions	Securing long term waste contracts that are appropriate composition
Improving government policies and commitment to resource	Planning and approvals processes are relatively long and costly
Government funding opportunities	Poor public perception
	Current WtE policy limitations

Source: Frontier Advisors

US vs. Australian experience

WtE is an established and accepted alternative for waste disposal and energy generation in North America and Europe. In fact, the US has been an early adopter of WtE technologies going back to the early 1980s. In contrast, Australia has seen limited support for the development of WtE facilities.

There are several historical reasons for this situation: plentiful landfill capacity in Australia has limited the need for alternative solutions; poor financial incentives, unfavourable public perception and community pushback, has not helped; and lack of government policy has failed to stimulate interest, innovation or investment in WtE.

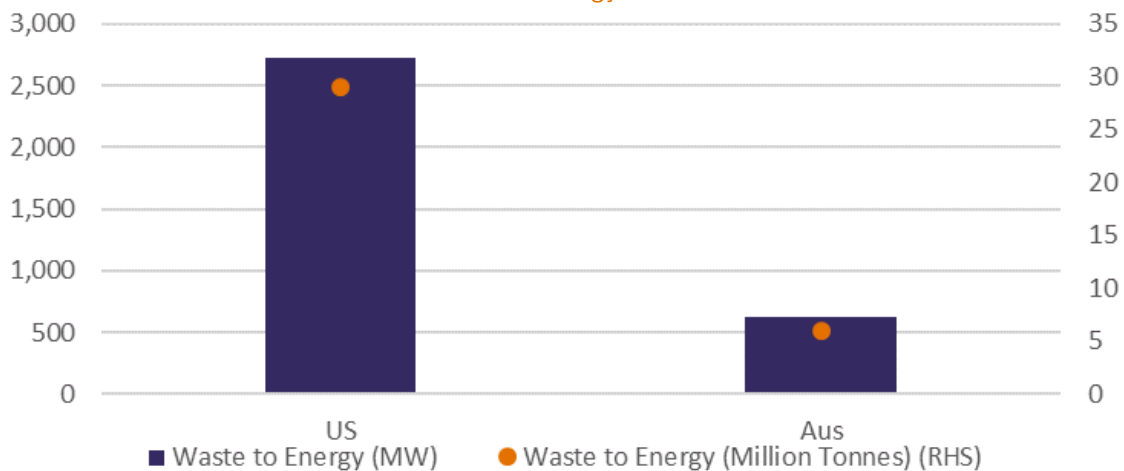
However, with China’s revised position on importing waste, the waste management industry in Australia has gained significant media attention. Moreover, increasing landfill charges, decreasing landfill capacity, difficulties in gaining council approval for new landfill sites, and a greater community expectation to do more than simply bury waste, are beginning to change the outlook.

In Australia, the Clean Energy Finance Corporation identified the potential for AU\$5 billion of new investment between 2015 and 2020 in the domestic bioenergy and WtE sector.

In the US, on the other hand, the government’s energy policies have supported the sector’s growth by allowing utilities to recognise WtE generation under the Renewable Portfolio Standard regulation.

The US now has an established industry with 86 WtE facilities across 25 states incinerating about 29 million tonnes of garbage annually – accounting for 11%² of the total US waste stream.

Chart 3: Waste To Energy – US vs. Australia



Source: Frontier Advisors

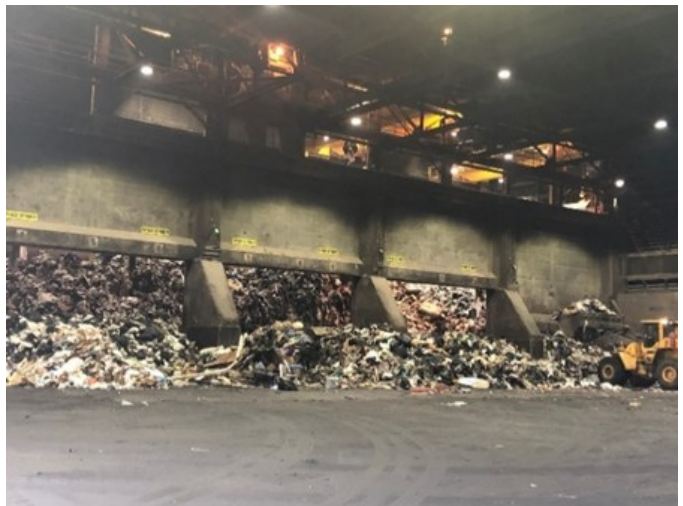
²Based on 258 million tonnes of annual waste production in the US, 'The power to see the road ahead', BAML report.

Frontier visits WtE facility

Frontier Advisors recently visited a Wheelabrator Technologies Inc. (Wheelabrator) owned WtE facility in New York, owned by Macquarie Infrastructure Partners (MIP) IV fund. Interestingly, the facility is located in the heavily populated area of Westchester, which demonstrates community acceptability and, more importantly, the plant's ability to meet clean air emissions regulations. Wheelabrator is the second largest WtE operator in the US (c.22% market share) with 15 facilities across the country. The largest US WtE operator, Covanta (c.53% market share), is listed on the NYSE. The WtE market in the US is otherwise fragmented with a number of active industrial companies and financial investors.

The Westchester facility is situated in Peekskill, New York, by the banks of the Hudson River. It commenced operations in 1984 and processes approximately 700,000 tonnes of waste annually, accounting for 90% of Westchester county's waste output, a significant waste conversion and avoidance of landfill. The facility has a long-term waste disposal contract with Westchester county. The plant has 60MW of energy production capacity and it also sells steam to the White Plains Linens laundry facility next door, thus diversifying its revenue base from tipping fees and electricity sales.

Figure 3: Westchester facility operating model and waste processing



Source: Frontier Advisors

Critics of WtE

Critics of WtE argue that WtE facilities are:

- high polluters;
- expensive; and
- undermine recycling efforts.

The key argument centres around the release of harmful toxins such as mercury, cadmium and lead. However, modern WtE facilities incorporate carefully engineered burn chambers and along with devices such as fabric filters, reactors, and catalysts, destroy or capture regulated pollutants. Any WtE technology will need to demonstrate adherence to local environmental standards and that impact on the surrounding community will be negligible.

The upfront capital costs of developing WtE plants are higher than landfill, and WtE facilities may only be cost-effective when processing at least 100,000 tonnes of waste per annum. This requires strong collaboration between local municipalities or councils and WtE developers and, ideally, some Government funding and incentives. Further, assistance with long-term waste and electricity supply/offtake agreements can secure the viability of such facilities.

Lastly, critics argue that WtE incinerators destroy valuable resources and they may reduce incentives for recycling. The question, however, is an open one, as European countries which recycle the most (up to 70%) also incinerate waste to avoid landfilling.

Investment opportunities

The waste related investable universe globally is currently small. The assets that are owned by infrastructure funds are typically in diversified infrastructure funds (making up a small part of the portfolio). Single waste-related investment opportunities arise occasionally, however, these must be evaluated carefully given concentration and complexity involved in the operation of such assets for investors; specialised knowledge and greenfield expertise are key.

Going forward, we expect investment opportunities in waste disposal to become more prominent given the challenge nations and local authorities face to deal with the c.500kg of municipal solid waste created per person per year globally.

Figure 4: Wheelabrator Westchester WtE Facility



Source: Wheelabrator Technologies

The final word...

Dealing with waste is a growing issue globally. WtE facilities provide an attractive investment thesis for investors with the evolving positive waste market fundamentals, high barriers to entry and growth potential of the industry. However, a specialised sector such as this is not without risk.

Reliance on policy support, potential for adverse environmental impacts (if not managed properly), technology risk and requirement for specialist knowledge mean opportunities must be evaluated carefully and commercially.





About Frontier Advisors: Frontier Advisors is one of Australia's leading asset consultants. We offer a range of services and solutions to some of the nation's largest institutional investors including superannuation funds, charities, government / sovereign wealth funds and universities. Our services range from asset allocation and portfolio configuration advice, through to fund manager research and rating, investment auditing and assurance, quantitative modelling and analysis and general investment consulting advice. We have been providing investment advice to clients since 1994. Our advice is fully independent of product, manager, or broker conflicts which means our focus is firmly on tailoring optimal solutions and opportunities for our clients.

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