Advances in waste processing and diversion from landfill in Australia

David Gamble

GHD, Sydney, Australia

Abstract

In Australia, economic growth over recent years has increased waste generation rates per capita beyond levels that would normally be attributed to population growth. On the positive side, an increased focus on recycling and waste minimisation by State and Local Governments has meant that waste recovery rates have been increasing at a much greater rate than waste generation rates, reducing the growth rates of waste disposal to landfill.

Economic instruments such as high waste levies in some states have also made recycling more attractive and supported the introduction of alternative waste technologies (AWT), which are seen as providing more sustainable long term disposal arrangements than landfills. The proposed introduction of a Carbon Pollution Reduction Scheme (CPRS) that covers methane emissions from landfills has provided increased focus on non-landfill based solutions.

Alternative waste technologies are expected to be the main focus for improved processing and resource recovery of municipal wastes in the immediate future. There is scope to extend this to commercial wastes. In NSW, there are already three AWT facilities in operation, two more being built and two more planned to be operating by 2010.

This paper discusses current progress in implementing AWT in Australia, and provides an update of recent projects and factors driving the implementation of new waste technologies in Australia.

Keywords

Alternative waste technology, AWT, sustainable waste management

1 Waste generation and recovery rates

In Australia, the amount of waste being produced and disposed of per head of population has progressively increased every year over the last decade. This has been mainly the result of a strongly growing economy, and higher standards of living.

1.1 Waste generation rates

High disposable incomes in the capital cities such as Sydney, Melbourne, Brisbane and Perth have meant higher personal consumption of food and material goods in those cities. Accordingly, the waste generation rate has risen by approximately 7% per annum, outstripping population growth during this period, which was of the order of 1.6% per annum. This is illustrated in Table 1.

There were significant improvements in levels of waste recovery (13.6% per annum) over this period. This resulted in the overall level of waste disposal only increasing by about 3.2% per annum on average between 1999-2000 and 2004-5. The annual growth in waste generation is expected to have slowed due to the effects of the economic downturn, although no data is yet available to verify this.

Table 1 - Growth of waste generation and recovery in Australia

	1999-2000	**2004-2005**	**Increase (%)**	**Ave annual increase (%)**
Tonnes generated (millions)	28.4	38.4	35%	7.0%
Tonnes recovered (millions)	10.5	17.6	68%	13.6%
Tonnes disposed to landfill (millions)	17.9	20.7	16%	3.2%

Source: WCS, 2008

Over the years, there have been slow improvements in the percentage of waste diverted from landfill, although the overall tonnages to landfill have increased. In 1999-2000, about 28 million tonnes of waste were generated, with 39% of this recovered and 61% disposed of to landfill. In 2002-3, approximately 32 million tonnes of waste was generated across the country, of which approximately 46% was recovered, and 54% was landfilled, as shown in Table 2. By 2004-5, more than 38 million tonnes of waste were being generated in Australia each year, with approximately 48% recovered, and 52% of this disposed of to landfill.

According to the Productivity Commission (2006), the quality of Australian waste management data has traditionally been quite poor. Each State and Territory collects and reports data differently, and there are gaps in the coverage of regions, waste streams and materials. Caution must therefore be used when comparing Australian waste generation, landfill and recycling rates with those of other countries. There is currently no national approach to sustainable waste management, as the Federal Government has traditionally left the management of non-hazardous wastes to the States and Territories.

1.2 Waste strategies

Most States and Territories have some form of waste management and recycling strategy. The New South Wales (NSW) Waste Avoidance and Resource Recovery Strategy set targets for Councils and businesses, as shown below in Table 3.

Table 3 - Targets from the NSW Waste Avoidance and Resource Recovery Strategy (2003)

Outcome area	Target
Preventing and avoiding waste	To hold constant the total waste generated for the next 5 years.
Increasing recovery and use of secondary resources	By 2014, to: Increase recovery and utilisation of materials from the municipal sector from the current 26% to 66% Increase recovery and utilisation of materials from the commercial & industrial sector from the current 28% to 63% Increase recovery and utilisation of materials from the construction & demolition sector from the current 65% to 76%

Source: DECC (2003)

1.3 Waste levies

To provide additional incentives for diverting materials from landfill and recovering resources, some States have introduced landfill levies, although these levies vary considerably between States. Some of the revenue collected is used to fund government waste minimisation programs.

A waste levy rate of A$47/tonne applies in the Sydney, Australia's largest city. (In contrast, a waste levy of A$15/tonne applies in Melbourne, Australia's second largest city). The State Government of NSW has stated that this levy will increase at a rate of A$7/tonne each year until it reaches A$57/tonne. Thereafter, annual increases will depend upon inflation.

2 Alternative Waste Technologies

2.1 Development

Mixed waste composting systems (such as Bedminster) were the first types of alternative waste technologies to be introduced to Australia. However, marketing of mixed waste derived compost for agricultural applications proved to be difficult, because of concerns about product contamination.

In 2001, a tunnel composting plant to process separately collected garden waste into high grade compost products was commissioned by the waste company Rethmann (now Remondis) at Port Macquarie, on the North Coast of NSW. Later, food waste was also separately collected, and composted at this plant, with good results. The compost product from this plant is successfully marketed to residential and commercial customers.

This same plant also used its tunnel composting technology to treat the residual waste from the residential collections, with an intention of producing a refuse-derived fuel (RDF). However, this initiative was never commercially viable, since there were no obvious customers for the RDF, and the treated residual waste is simply landfilled.

Anaerobic digestion of separately collected commercial food wastes had been undertaken since approximately 2001, at the Earthpower plant in Western Sydney. However this plant struggled to attract commercial wastes, due to low costs of landfilling (at the time) and much of the material that the customers delivered was highly contaminated with non-organic wastes. The processing costs were therefore quite high, and the plant did not ever reach design capacity.

The largest AWT facility to be built in Australia to date has been the Global Renewables plant at Eastern Creek. This is an anaerobic digestion plant with a mixed municipal waste feedstock. This plant was highly engineered, and very sophisticated, but there were issues with large quantities of lead acid car batteries received in municipal waste deliveries. While the plant produces green energy to feed into the electricity grid, the mixed waste compost it produces has proved difficult to market.

The most recent AWT facility to be commissioned in Australia is the Ecolibrium facility at the Macarthur Resource Recovery Park in Southwestern Sydney. This uses the Arrow Bio technology from Israel. Another AWT facility, the SITA Advanced Waste Treatment (SAWT) facility at Kemps Creek, in Sydney's west is now being commissioned. The ArrowBio plant uses anaerobic digestion for organics processing, while the SITA plant uses mixed waste composting technology to produce a mixed waste compost for rehabilitation of the Elizabeth Drive landfill site, where it is located.

Table 4 - Summary of alternative waste facilities in Australia to 2009

AWT Facility operator	Location	Approximate annual throughput (tonnes)	Type of technology	Year in operation
SITA (formerly Bedminster)	Port Stephens (NSW)	30,000	MWC	1999
Atlas	Stirling (WA)	100,000	MWC	2000
Earthpower	Camellia (NSW)	80,000	AD	2001
Remondis	Port Macquarie (NSW)	30,000	SOC/MWC	2001
SITA (formerly Bedminster)	Cairns (Qld)	50,000	MWC	2003
Global Renewables	Eastern Creek (NSW)	180,000	AD/MWC	2004
SMRC (formerly Bedminster)	Canning Vale (WA)	120,000	MWC	2004
WSN	Macarthur (NSW)	90,000	AD/SOC	2008
BioMass Solutions	Coffs Harbour (NSW)	40,000	SOC/other	2008
SITA (SAWT)	Kemps Creek (NSW)	120,000	MWC	2009
Conporec	Mindarie (WA)	100,000	MWC	2009
Anaeco	Shenton Park (WA)	30,000	AD	2009
TOTAL		970,000		

AD = anaerobic digestion, MWC = mixed waste composting, SOC = organics composting

It is widely believed that the NSW Waste levy has provided a significant driver for wider adoption of alternative waste technologies in Sydney, as there are more AWT plants operating in the Sydney area than in any other capital city. (There are no plants in Melbourne where landfilling prices have been very low and the waste levy is only A$15/tonne).

Recently, the gate fees for Sydney's major putrescible waste landfill sites reached a level of A$150/tonne for the first time (including A$47/tonne levy). This makes the treatment of waste (estimated cost A$100-$140/tonne) much more cost effective than landfilling of mixed waste, which should result in an increased number of new AWT plants built in Sydney over the next few years.

However it is clear from current data that there are unlikely to be enough AWT facilities commissioned and operating in NSW before 2014 for the NSW Waste Strategy targets for municipal waste (refer Table 3) to be achieved. Also there are insufficient economic drivers to force commercial wastes to be diverted to AWT facilities, so it is unlikely that the commercial waste targets will be met either.

Even in Sydney, where landfill charges are the highest in the country, the cost of waste disposal for businesses is still relatively low compared with other more significant operating costs, such as labour and rent.

Private consortiums and existing waste companies responding to tenders from Local Government have built most of the AWT plants in Australia to date. Generally Councils have entered into contracts with these service providers for periods ranging from 10-20 years. The contracts are for financing, construction and operation of the AWT facility, with the Council (s) agreeing to direct all municipal waste that they or their contractors collect from residential areas to the plant for this contract period, and often to pay an availability fee to cover the financing costs of the plant, plus an agreed rate per tonne of waste received. In some cases, Councils have also provided the land and environmental approvals for the successful tenderers.

There are no AWT facilities currently operating in other capital cities, such as Brisbane and Melbourne. However, the Victorian State Government is currently examining the best way of introducing AWT into Melbourne, through its Victorian Advanced Resource Recovery Initiative (VAARI) scheme. This may eventually result in State Government assistance or incentives for establishing three such plants in the Melbourne metropolitan area within the next 5-10 years.

2.2 Other drivers for reducing waste to landfill

One of the most significant drivers for encouraging AWT processing of municipal and commercial wastes in Australia will be the proposed introduction of the Federal Government's Carbon Pollution Reduction Scheme (CPRS). From July 2010, the introduction of the CPRS will mean that there will be a price placed on carbon dioxide and five other greenhouse gas emissions including methane.

This is the first time in the world that waste has been included in an emissions trading scheme. The European system does not include waste, however in Europe there are other drivers that are not in place in Australia, such as the European Landfill Directives, that reduce the amount of untreated waste going to landfill.

The cost of carbon pollution permits is projected to be around $23 per tonne in 2010/11 when the CPRS is due to commence. An emissions price cap will be set at $40 per tonne in 2010/11 and will rise by 5 per cent above CPI each year for the first five years thereafter. The scheme is designed to link with international markets and other trading schemes that generate Kyoto compliance permits. Liable parties will not be subject to any quantitative limitations on the number of Kyoto compliant permits that they use.

Specific implications of the CPRS for waste sector operators include direct liability for fugitive emissions and therefore a requirement to purchase and acquit permits. Waste operators may also have a direct liability for fugitive emissions.

Features of the scheme that affect waste facilities include:

- Landfill facilities that emit 25,000 tonnes CO2-e a year or more will be required to purchase and acquit permits for each tonne of CO2-e emitted;
- A participation threshold of 10,000 tonnes CO2-e or more will apply to landfill facilities that are operating in proximity to another operating landfill (criteria to be determined);
- Emissions from landfill sites closed prior to 30 June 2008 will not be covered;
- Liability for emissions from past waste streams (legacy waste) will be excluded from the Scheme until 2018;
- Legacy emissions will need to be reported and counted towards a facilities' Scheme participation threshold; and
- Methane that is captured will be allocated proportionally between legacy and new emissions.

The introduction of the CPRS will increase the cost of operating landfill facilities, by an estimated A$5 -A$15/tonne, depending upon the throughput and whether the sites have existing landfill gas management systems. This cost increase is not significant in Sydney, where a landfill levy of A$47/tonne already applies, and overall gate fees are approximately A$150/tonne.

However, in many rural areas where landfill gate fees are still relatively low ($30-$50/tonne), the CPRS liability could have a dramatic impact on the costs of operating waste management systems. This may encourage greater source separation of wastes, and adoption of lower cost AWT systems such as food and garden waste enclosed composting.

2.3 The Future of AWT in Australia

Despite AWT facilities becoming more common in Australia, there is still a high degree of scepticism about the claims made by many technology providers about the performance of AWT facilities generally. The technical and commercial failure of technically complex plants such as the SWERF gasification plant in Wollongong has created a lack of trust in AWT facilities. Even plants using relatively mature technologies such as the Bedminster process have had technical issues. Local Councils are conservative by nature and therefore wary of new technologies of any type.

Therefore they are inclined to select technologies that are either well proven in Australia, or overseas. Any technology provider seeking to market waste technologies in Aus-

tralia must be aware of this. However, there is a general lack of awareness in Australia of more than the handful of technologies that are currently used in this country. There are opportunities for European technology providers with a strong track record of many years of successful operations in Germany or other countries with a large number of operating facilities to enter the Australian market, especially if they partner with a local waste company.

Due to issues faced by plant operators who are trying to market mixed waste compost, the likely future trend is towards energy production, rather than composting technologies. Therefore there are likely to be more anaerobic digestion plants built to serve the major cities. In regional centres, it is more likely that food and garden waste composting plants will be adopted, because of their simplicity and lower costs, and reliable local markets for high grade agricultural compost.

As mentioned previously, there have been difficulties in directing commercial wastes to AWT facilities without laws in place to make this happen, and this is a big challenge in trying to meet State waste strategy targets. One possible solution that has been canvassed is for operators of municipal waste facilities to “top up” their plant throughputs, with commercial waste. Some facility agreements with Councils already allow this, with Councils receiving royalties or a share of the profit associated with commercial customers using their facilities. Businesses with corporate sustainability objectives are interested in diverting a high percentage of their waste from landfill, and maximising their recycling achievements, so there are a number of potential customers in the market.

In Europe, a large number of the waste processing plants produce refuse derived fuels (RDF) from waste, for energy production. None of the current AWT plants in Australia do this. There are commercial reasons, such as lack of markets for the material and lack of purpose built facilities for these fuels.

It should be mentioned that there is considerable reluctance to build and operate any type of thermal waste treatment plant in Australia. There are concerns that dioxins and other pollutants could increase health risks to surrounding populations. Hence siting of such a facility would be problematic. Hence it seems most likely that co-firing of RDF in cement kilns and power stations on a small scale will be the main application for RDF from waste facilities in future.

3 Summary

This paper has examined the current progress, drivers and possible trends in alternative waste technologies in Australia. Whilst there are many AWT plants being built, it is likely that rate of completion of new facilities will be slower than required to meet State waste

strategy targets, and that commercial wastes will continue to be difficult to attract to these facilities.

4 Literature

DECC (2003),	Waste Avoidance and Resource Recovery Strategy 2003, Department of Environment and Climate Change NSW
Productivity Commission 2006	*Waste Management*, Report no. 38, Canberra. ISBN 1 74037 208 5
WCS (2008)	The Blue Book – Australian Waste Industry 2007-8 Industry and Market Report , WCS Market Intelligence 2008
WSN Environmental Solutions	Waste Services and Charges, Issued 2 Jan 2009

Author's address(es)

David Gamble
GHD Pty Ltd
10 Bond St
Sydney, 2000, NSW
Australia
Telephone +61 2 9239 7354
Email dgamble@ghd.com.au
Website: www.ghd.com.au