

The Role of Alternative Waste Technologies in Australia in Achieving Sustainable Waste Management

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Die Rolle der alternativen Abfalltechnologie auf dem Weg zur nachhaltigen Abfallwirtschaft in Australien

Abstract

This paper provides an overview of policies and regulatory drivers, current practices and possible future developments in management of non hazardous wastes in Australia. It specifically covers:

- Waste policy framework and drivers in Australia, using New South Wales (NSW), Australia's most populous State as an example;
- Overview of how municipal waste is currently managed, focusing on NSW where landfilling charges are the highest in the country; and
- Existing and planned alternative waste technology facilities in Australia, reasons for selection of particular technologies and their likely role in meeting sustainable waste management policy objectives.

Most States and Territories in Australia have some form of waste management and recycling strategy. To provide additional incentives for diverting materials from landfill and recovering resources, some States have introduced landfill levies. A limited amount of the revenue collected is used to fund government waste minimisation programs.

Alternative waste technology (AWT) facilities are currently operating at Port Macquarie on the NSW North Coast, Port Stephens, Western Sydney, Cairns and Perth. New facilities are being built in South West Sydney, Perth, and Coffs Harbour.

A wide variety of technologies are being used, some producing energy, others focussing on production of compost or volume reduction and stabilisation. Many regional Councils are investigating AWT solutions, however there have been a couple of failures which have limited the rate of adoption of new technologies.

Increasing costs of disposal for waste generators, higher levels of expectation for environmental performance, legislation and regulation and the resulting changing characteristics of the residuals urban waste stream are likely to lead to increased future demand for more technologically sophisticated waste management solutions such as AWT facilities.

Keywords

Alternative waste technology, AWT, sustainable waste management

1 Policies and regulations

In Australia, most of the specific policy drivers for municipal, and commercial and industrial (non-hazardous) waste management are currently at a State level, rather than at a national level. About 80% of municipal waste is still landfilled across Australia.

Most States and Territories have some form of waste management and recycling strategy. To provide additional incentives for diverting materials from landfill and recovering resources, some States have introduced landfill levies. A limited amount of the revenue collected is used to fund government waste minimisation programs:

- ▶ In NSW, the waste levy is now over \$29/ tonne, and will be progressively increasing by \$7/tonne each year until it reaches \$57/tonne. Half of the annual increase has been promised to local government if it meets performance targets dictated by the State.
- ▶ In Victoria, some 70% of the \$5 – 11/ tonne levy funds a state waste minimisation body, Sustainability Victoria. Limited direct grants are made to local government.
- ▶ In South Australia, 50% of the \$10.50/ tonne levy funds the state body, Zero Waste SA.
- ▶ Western Australia's levy was recently doubled to \$6/ tonne to fund the State's 'strategic waste initiatives'.
- ▶ Queensland does not currently have a landfill levy, however it is being considered.

The principal responsibility for regulating waste management in NSW lies with the Environment Protection Authority (EPA). The EPA can issue licences to operators of waste facilities and transporters of waste. The EPA is now part of the Department of Environment and Conservation (DEC), and is responsible for administering the Protection of the Environment Operations Act 1997 (POEO Act). The Sustainability Programs Division of the Department of Environment and Conservation (DEC) develops, coordinates and evaluates the implementation of strategies and programs for the state-wide achievement of government policy objectives in NSW.

The NSW Waste Avoidance and Resource Recovery Act 2001 (WARR Act) governs the strategic direction for waste management and resource recovery in NSW. The Waste Avoidance and Resource Recovery Strategy 2003 ('the Strategy') defines the broad objectives for waste management, which include holding constant the total waste generated for the next 5 years and increasing the recovery and utilisation of materials from the municipal sector from the current 26% to 66%, and from the commercial and industrial sector from the current 28% to 63%. This provides a significant driver for wider

adoption of alternative waste technologies, such as mechanical biological treatment (MBT), especially in NSW.

2 Waste disposal in NSW

2.1 Quantities

Waste disposed of to landfill in NSW, which has a population of approximately 5 million people, is difficult to estimate with certainty. In 2004, the DEC reported that the amount of waste disposed of across the State had remained constant at around 6 million tonnes. Within the Sydney Metropolitan Area, and the Extended Regulated Area, approximately 1.7 million tonnes of municipal solid waste, 2.4 million tonnes of commercial and industrial waste and 1.2 million tonnes of construction and demolition waste was disposed of to landfill.

Approximately 0.5 million tonnes of municipal solid waste and 0.5 million tonnes of commercial and industrial, and construction and demolition waste was disposed of from rural areas. These figures do not include recyclables collected, and recovered, nor garden waste or construction or demolition materials diverted from landfill.

Solid waste quantities for 2002-3 for the whole of Australia are presented below.

Table 1 Solid waste quantities for 2002-3 for Australia (Source: Productivity Commission, 2006)

<i>State/Territory</i>	<i>Municipal</i>	<i>Commercial and industrial</i>	<i>Construction and demolition</i>	<i>Total</i>	<i>Per person</i>
	kilotonnes	kilotonnes	kilotonnes	kilotonnes	kilograms
New South Wales	3 326	4 196	4 649	12 171	1 828
Victoria	2 291	2 743	3 575	8 609	1 763
Queensland ^a	1 742	959	1 166	3 973	1 057
Western Australia ^b	833	744	1 945	3 522	1 820
South Australia ^c	600	677	2 156	3 433	2 255
Tasmania ^d	142	na	na	na	na
ACT ^a	111	150	250	674	1 420
Northern Territory ^e	68	na	na	na	na
Total	8 903	9 469	13 741	32 382	1 639

^a Total waste generation estimates for Queensland and the ACT include 105 kilotonnes and 163 kilotonnes of 'organics' respectively that were recycled by the private sector but were not disaggregated by source sector as the split was unknown. ^b Incorporates recycling data for the financial year 2004-05. Waste generation estimates incorporate landfill disposal data that are for metropolitan Perth only. ^c Data are for calendar year 2003. The estimate of total waste generation includes meat waste, a prescribed industrial waste, which was included in the recycling data. ^d Municipal waste generation is the sum of the total amount of municipal waste disposed to landfill and the total amount of recyclable material collected via kerbside recycling services. Kerbside collection data are for 2004-05 and are only available for 9 out of 29 local governments. ^e Not included in total figures. Municipal waste generation is the sum of the total amount of waste disposed to landfill to the total amount of material sold or sent for secondary use (including energy recovery) from kerbside recycling services. na Not available.

2.2 Current methods of disposal for putrescible wastes

A State Government Owned Corporation called WSN Environmental Solutions (WSN) owns and operates most of the putrescible waste infrastructure in Sydney. It runs ten waste recycling, processing and disposal facilities, including all of Sydney's licenced putrescible landfill facilities (four landfills at Eastern Creek, Lucas Heights, Belrose and Jacks Gully), and a network of waste transfer stations scattered throughout the Sydney Metropolitan Area to service these landfills.

In competition with WSN, Veolia Environmental Services operates Sydney's only privately owned putrescible waste transfer station, at Clyde in Sydney's west, which handles approximately 400,000 tonnes of waste from Sydney per year,. This material, which is mainly putrescible in nature (a combination of municipal and commercial/industrial waste) is loaded into shipping containers and transported by train daily to the Woodlawn Bioreactor Landfill, located in a disused open cut mine on the Southern Tablelands of NSW near Goulburn. This facility will eventually generate at least 10 Megawatts of electricity from the biogas produced in the bioreactor landfill.

A third player in the Sydney market is Global Renewables Limited (GRL), which operates Sydney's first large-scale Alternative Waste Technology (AWT) facility for household waste, the UR-3R facility located at Eastern Creek. The UR-3R facility processes approximately 200,000 tonnes of municipal solid waste annually, extracting recyclables, and producing electricity and organic products. It cost approximately \$70 million to build.

Veolia also operates non putrescible waste landfills at Horsley Park and Riverstone in far Western Sydney. Other organisations also operate non putrescible waste landfills in western Sydney. SITA operates Sydney's only licenced Industrial waste landfill at Kemps Creek, which accepts more highly contaminated materials than the other sites, which can only accept Inert Wastes, and Solid Waste Class 2.

A company called Earthpower operates an anaerobic digestion facility at Camellia, which produces electricity (from biogas) and fertiliser from solid commercial and industrial food wastes. This has a capacity of approximately 100,000 tonnes/year, and cost approximately \$30 million to build. However its capacity has never been fully utilised by industry.

Outside the Sydney region, the majority of waste facilities comprise landfills that generally accept less than 100,000 tonnes per year. These facilities are mainly owned by local Councils, and either operated by Council staff or contractors. They receive both municipal and commercial wastes, as there is no differentiation between landfill types outside the Sydney Region.

However, alternative waste technology (AWT) facilities are currently operating at Port Stephens (north of Newcastle), Port Macquarie on the North Coast and at Lismore in Far Northern NSW. A Bedminster plant at Port Stephens processes approximately 30,000 tonnes per year of municipal solid waste, producing a compost type product suitable for restricted uses.

At Port Macquarie, a novel approach (for Australia) to waste collections ensures that a higher quality compost is produced. Residents place food wastes in the same bin as garden wastes, which are collected weekly. All other wastes are placed in a “dry” waste bin, which is collected fortnightly. This permits the organic wastes to be converted to a high grade compost by tunnel composting, while the dry wastes are treated in a similar way, before being disposed of to landfill.

In Lismore, a similar waste collection system is in operation, but the organic wastes are taken to a large mechanised worm farm which was designed and operated by a company called Tryton Engineering. The worm castings and liquid fertiliser from this process are of high quality and are marketed accordingly. It is understood that the capital cost of this plant was of the order of \$10 million, and it treats about 10,000 tonnes per year of waste.

2.3 Future AWT developments in NSW

Jacks Gully AWT Facility

Sydney's MACROC councils (Campbelltown, Camden, Wollondilly and Wingecarribee) recently awarded Sydney's biggest alternative waste technology contract to WSN Environmental Solutions. The contract comprises \$150 million over 15 years to build and operate a facility at the Jacks Gully Waste and Recycling Centre in Sydney's southwest. The capital cost of the plant is of the order of \$50 million.

The Ecolibrium Mixed Waste Facility uses the ArrowBio technology developed in Israel. This relies on water to aid separation of recyclables, and transportation and anaerobic digestion of the organic component of municipal solid waste. This technology, which has been used in a 30,000 tonne per year plant in Tel Aviv for a number of years, is relatively compact, and has a low odour impact, due to immersion of the waste in water early in the process.

The Resource Recovery Park will also include a 30,000 tonne capacity materials recyclables facility and a fully enclosed tunnel composting system for processing 30,000 tonnes of garden organics per year. WSN anticipates that the Resource Recovery Park (including AWT facility and organics processing plant) should be fully operational by

2008. WSN wishes to build a number of similar facilities in the Sydney region, subject to long term agreements from councils or groups of councils for receipt of waste.

Coffs Coast Resource Recovery Facility

Coffs Harbour and surrounding Councils on the North Coast of NSW recently entered into a contract with a newly formed company called Biomass Solutions to provide a new AWT facility for the region. The technology proposed for this plant is an aerated floor with mechanised turning for the organic wastes (food and garden wastes), plus auto-claving of the non organic wastes followed by removal of metals and plastics, and land-filling of the residuals. The operators anticipate that a refuse derived fuel can be produced from the paper and plastic components of these residuals in future.

Hunter Valley Regional Facility

Thiess Services is the preferred contractor and technology supplier for a proposed AWT facility in the Hunter Valley north of Sydney. The proposed technology is the Steinmuller Valorga anaerobic digestion process. This project was supposed to proceed in 2003, but stalled for unknown reasons. Indications are that it may recommence soon.

2.4 Current and future AWT developments in other States

There are two Bedminster plants operating outside NSW at present. They are located in Cairns (Far North Queensland) and in Perth (Western Australia). Both plants process municipal solid waste, and produce a compost type product suitable for restricted uses. A composting plant is operated by Atlas on behalf of the Stirling Council of Western Australia. This produces a low grade compost type product which is applied to agricultural land owned by Atlas.

In September 2004, the Western Regional Waste Management Group (WRWVG) in Melbourne Victoria (WRWVG) selected Global Renewables as the preferred tenderer to provide resource recovery services, through building, owning and operating a UR-3R Facility to receive and process 225,000 tonnes of municipal solid waste per annum sourced from the WRWVG member councils. Apart from this facility, no other AWT facilities are known to be planned for Victoria at present.

A municipal waste composting plant using the Conporec technology from Canada is to be constructed by the Mindarie Regional Council in Perth Western Australia. This technology is broadly similar to the Bedminster technology in that it uses a rotating aerobic composting drum at the front of the plant, followed by secondary separation, aerated floor maturation and compost refinement.

3 Reasons for selection of particular technologies

Generally, there is a high level of interest in Australia in the use of alternative waste technologies (AWT) to reduce the amount of waste going to landfill. In NSW, there are already four alternative waste technology facilities in operation, and two more are being built at present. Three of the four current facilities are in regional areas, and are based upon reasonably mature or simple technologies such as the Bedminster process, vermiculture or tunnel composting. This reflects a high degree of conservatism in the selection of alternative waste technologies in Australia.

It should be realised that waste to energy technologies such as mass burn incineration are not generally favoured in Australia for anything other than medical wastes. The Waverley-Woollhara Incinerator in Sydney was closed down more than 15 years ago, due to not being able to meet emission standards set by the authorities. Since that time, no new proposals have been submitted for approval, despite ever increasing quantities of waste being sent to landfill.

A few years ago, a Council, in the City of Wollongong (south of Sydney), entered into a contract with a company called Energy Developments Limited (EDL) to establish a SWERF plant at its Whytes Gully landfill site. This was based upon a waste gasification process, which had not ever been fully tested on municipal solid waste. The plant unfortunately suffered a number of operational problems and was shut down. This was after agreements for new plants had been negotiated with other Councils in Australia, as well as overseas Councils such as Derby in the United Kingdom.

Ever since that time, Local Government has been reluctant to select highly sophisticated and (in their eyes) unproven technologies. Hence the Southern Metropolitan Regional Council and Mindarie Regional Council in Perth both selected proven but less sophisticated Bedminster and Comporec plants respectively instead of energy production plants.

The most technologically advanced AWT facility in Australia, the UR-3R plant in Western Sydney, was built by WSN Environmental Solutions, on the basis that one local Council (Fairfield) would be contracted to send all of its waste there, and provide the base load for the facility for a period of 20 or more years, and that other local councils would sign up once they were convinced that it worked. In fact, all of the capacity of the plant has since been sold to other councils, who liked what they saw.

In, seven Councils in the Macarthur Region (MACROC) in South West Sydney called for tenders for an operator to receive and process approximately 90,000 tonnes per year of municipal solid waste from the region, as well as garden wastes. Their move to AWT was largely being driven by concerns from their local communities about the impacts of landfilling at the current Jacks Gully site, the future availability of landfill space in the

region and by the costs of landfilling, which had reached more than \$100/tonne and were still rising.

The MACROC tender called for a diversion of more than 75% of waste to landfill, low environmental impacts from operation (traffic, noise and odour), and environmental sustainability of the facility. It also required the technology to be “proven”, to avoid what had happened at Wollongong. The ArrowBio technology met this criteria.

There are indications that other groups of local councils in Sydney are getting ready to go to collective tender for AWT type solutions. It is expected that these tenders will be similar, in that they will require an operator to provide a service for 15-20 years to receive the waste from the region, treat it to an acceptable standard, produce compost and/or energy, and dispose of the residuals in a landfill.

Generally the operator must find their own site, and obtain their environmental planning approvals. This can make tendering on such projects quite difficult because there are very few sites in close proximity to Sydney that are appropriately zoned for waste related activities. Generally operators who propose to build facilities on existing landfill sites are most likely to succeed.

4 Likely role of AWT in meeting sustainable waste management policy objectives

One of the key objectives of the NSW Waste Avoidance and Resource Recovery Strategy 2003 is to increase the recovery and utilisation of materials from the municipal sector from the current 26% to 66% (a 40% improvement).

Since AWT generally offers a diversion rate from landfill of approximately 70-80%, this means that approximately half of the total quantity of municipal solid wastes generated across NSW would need to be sent to AWT plants to achieve this target. In Sydney alone, this means that about 0.8 million tonnes of municipal solid waste would need to be treated each year in AWT facilities. If a typical facility treated 0.2 million tonnes of material per year, 4-5 new AWT facilities would need to be built in the Sydney area to cope with this demand.

The current high prices for recyclables (steel, aluminium, mixed plastics and paper), which is driven by demand from overseas economies such as China, provide additional financial incentives for extraction of these materials from municipal solid waste. Renewable energy credits which have a high market value are also available for anaerobic digestion type facilities which produce energy from biogas. The markets for municipal solid waste derived compost products are a little uncertain at present, because insuffi-

cient material has been generated to provide buyers with a high level of confidence in its quality. This will no doubt be addressed over time.

Unfortunately, these products compete directly with green waste derived composts, which themselves are in an oversupply situation within the Sydney Region at the present time. There are potential markets in Western NSW for both of these products, if the costs of transport can be overcome (possibly through subsidies). A definite need exists to replace the depleted organics in soils in agricultural areas, and replace chemical fertilisers, so it is hoped that a solution can be found.

Obviously AWT facilities are more expensive to build and operate than landfills, but they offer a sustainable solution to what the community perceives as an ever-growing waste problem. It is also quite difficult to obtain planning approvals for new putrescible waste landfills, especially in Sydney, and AWT facilities are more accepted by local communities.

The take-up of AWT in some States such as Victoria will be slower than in NSW due to relatively low landfilling charges and lack of regulatory drivers, such as the need to pretreat all wastes going to landfill, that exist in Europe. As AWT facilities are already established in Cairns (Qld) and Perth (WA), where landfilling charges are lower than in Victoria, this suggests that it is not only driven by high landfilling fees, but by community pressure to minimise landfilling.

Eventually, AWT facilities will be operating in a large number of locations throughout Australia. It is likely that there will be no single "best" technology solution, but a variety of different technologies being used, with varying success.

5 Summary

The popularity of AWT in Australia for managing municipal solid waste is expected to continue in future. High landfilling charges in NSW suggest that the largest number of plants will initially be built in NSW, but there are indications that other States will follow, once waste charges increase to sufficient levels to justify the capital investment (and correspondingly higher gate fees) involved, or for sustainability reasons.

6 Literature

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