The Australian Experience of MBT Submissions

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Abstract

Alternative waste management systems offer the technologies that may be technically, environmentally and financially viable, but need to specifically address regulatory issues, community perception and skeptism of claims made.

WSN has been developing its alternative waste technology (AWT) strategy, using MBT technology as the preferred solution for progressive implementation at its waste management centres in the Sydney metropolitan area and in other parts of the State of New South Wales.

This paper looks at the difficult issues and decisions that confronted this company in the selection of the MBT processes such as functionality, economics, outputs, emissions and regulatory risks of technologies sourced from overseas.

Keywords

International Symposium MBT 2005, Hanover, Australia, WSN Environmental Solutions, Market, Regulatory and Commercial risks,

1 Introduction

Australia generates 21.2 million tonnes of solid wastes from a population of 20 million. This amounts to 1.1 tonnes per capita disposal per year and places the country second highest in the OCED countries and next to the United States.

There is variability between the 7 states that comprise Australia from 0.8 tonne per capita in the Capital Territories to 1.4 tonnes per capita in Western Australia

The average waste composition across Australia is 40% domestic waste, 23% commercial and industrial waste and 37% construction and demolition waste.

Domestic or household waste includes foodwaste, garden wastes, paper, glass, metal cans and plastics. The per capita disposal waste for the domestic stream (MSW) is 620 kg/year placing it second to the USA

Australia has 9 operating alternative waste treatment plants and 3 plants under development. The majority (8) are aerobic MBTs with 3 hybrid anaerobic/aerobic MBTs and one anaerobic plant .The installed capacity is estimated at 500,000 tonnes of waste, treating MSW, Biosolids, commercial organics and food waste

2 WSN Environmental Solutions (WSN)

WSN is a government owned corporation trading competitively in the market to secure its waste in the State of New South Wales (NSW).WSN handles about 1.7 million tonnes of waste per year.

It is NSW's major provider of waste management and recycling services. It owns and operates 4 major landfills, 6 large waste transfer stations, 2 Material Recovery Facilities and has recently introduced its first alternative waste technology plant (AWT) in its network .This MBT technology employs waste separation, aerobic and anaerobic processes.

In NSW, the per capita disposal rate is lower than the national average. Local government data for 2001/2 shows that 23 % of total MSW was recycled with 98% of the population having access to kerbside collection. However there remains 1.3 million tonnes available for Alternative Waste Technologies (AWT). WSN has secured 175,000 tonnes to its Eastern Creek facility in Sydney but is looking to divert more waste away from its landfills. The Eastern Creek plant is a Public Private Partnership with GRL, a local company using patented technology from Germany and Italy and combining it with their mining experience.

2.1 The reason for change

Landfilling is currently the dominant method for solid waste disposal in Australia. Its attraction lies in its perceived short-term cost advantages. There are growing public concerns with the current landfilling process relating to its potential for air and water pollution. Methane and carbon dioxide, the major components of landfill gas, are recognised as significant greenhouse gases. Although WSN captures its landfill gases, there are fugitive emissions that give rise to odour complaints. Landfill sites pose a major threat to the environment, namely the potential loss of leachate to the surrounding water and soil. The chemical composition of the leachate varies, depending on the age of the landfill and the quality of waste disposed of in the particular landfill. The variability is further exacerbated by the fact that leachate being generated at any point in time is a mixture derived from solid wastes of different ages. This variability in leachate quality makes its treatment difficult. As environmental concerns become entrenched in legislative regulation, and their cost of implementation incorporated into disposal costs, the economics increasingly favour practices that minimise environmental impact.

Since the landfills present potential environmental threats, care, monitoring and management of the sites are required for long periods, well after the sites are closed. Even with the improved environmental controls and better techniques, the consensus now in NSW is that landfilling is a technology of the past where value associated with the waste as a resource is lost. Commercially, the landfill capacity within the Sydney metropolitan area has a finite life. Efforts to secure suitable sites for landfills in the metropolition area is unlikely. This is moving the industry and local councils towards adopting waste management practices and technologies that provide improved environmental and social outcomes. However whilst landfill disposal gate fees remains low ($25 – $35) in other parts of Australia, the economic incentive to change is dormant. In Sydney the landfill fees are higher, in the order of $90 -$110. This presents opportunities for AWT. The NSW EPA has forecast increases in levies from $22 today to $ 50 by 2027.Although this is helpful, the rate of increase and the quantum is insufficient as a quick driver for change. Levies in the UK and Europe are significantly higher.

2.2 Why MBT

WSN called for a worldwide Expression of interest in November 2000 and received 48 submissions. They covered the suite of incineration, gasification, pyrolysis, mechanical pretreatment, aerobic and anaerobic processes.

It was clear at the outset that apart from costs, incineration, gasification and pyrolyis would meet with resistance from customers and environmental groups on the grounds of perceived emission problems. Sydney had recently closed down its incinerator (1997) as a result of emission issues. Despite considerable advances in thermal technologies advancing these technologies posed considerable investment risks for treating MSW. The failure of the Australian grown SWERF gasification process (2003) has made investors nervous and the public skeptical .As is the case, other AWT processes get tainted with the same brush.

Pretreatment and MBTs are perceived as tried, proven processes, moderately risky and are generally more acceptable to the customers and Non Government Organisations (NGOs). The WSN EOI received 17 submissions including pretreatment and MBT processes.

2.3 The MBT experience

WSN went through a learning curve over the last 4 years in understanding issues around MBT plants. While all MBTs seemingly do a similar job, there are nuances that need to be understood. An MBT can be configured in different ways and its outputs and quality can be different .The impacts during pretreatment of the choice of equipment and screen sizes has an effect on the material characteristics and flow. The process could be aerobic or anerobic or a hybrid process. Anaerobic digestion itself could be a wet or dry process, single stage or two stage and they could be mesophillic or thermophyllic. There is no one solution because each process has its advantage for a given waste characteristic. One needs to ask if the focus is on producing products for landfill, or solid derived fuel, or compost use, or is the prime focus to maximise energy or combinations of these. They are not simple matters to understand and pose a significant challenge and corporate reponsibility when proposing a particular system to a client and working out the business case. Very often clients and end users of the service evaluate the processes in a short time frame and often with limited proprietary information. They are presented with a technology proposal that is a global fix.

Often limited data is available of the input stream of waste from the vendor's technology reference site. Nearly always clients expect the vendors to take the waste composition risks. No definitive waste characterisation data is available and statistical data bases can lead to over and under statements of particular categories .Waste characteristics vary from country to country and by regional and seasonal changes. Additionally waste could vary over the time of the contract as technology, materials and regulations change over time as efforts are made to segment and maximise recovery. The vendor in turn will stipulate these exclusions to protect their interests. The technical and economic modelling and business outcomes are complicated and cannot be solved with a simple evaluation process. This puts the clients at a significant disadvantage when trying to differentiate the merits of various proposals from vendors. It is better for them to stipulate the outcomes contractually rather than try to resolve the technological nuances.

Furthermore, the lack of any definitive regulatory guidelines and market based instruments (such as LATS in the UK) gives rise to uncertainty and inhibits investments for AWT in Australia.

Australia is not a signatory to the Kyoto Protocol and will find it difficult to participate in the Carbon trading markets. However the Australian Federal Government has some limited incentives to produce Green Electricity. A target called the Mandatory Energy Target (MRET) to achieve 9500 GWh of extra renewable energy by 2010 and to maintain that level until 2020 has been established. However, the future for this scheme is uncertain after 2020. In the interim, this enables tradable certificates called RECs (1 REC = 1 MWh) to be used to offset against the National Greenhouse abatement scheme. 1 REC trades at AUD $ 35. There are liable parties in the MRET scheme such as retailers and wholesalers of electricity who are expected to purchase renewable energy in a calculated proportion to the electricity they purchase from coalfired sources. The penalty is AUD $57 per MWh for purchases not covered by a REC. Anaerobic digestion is eligible as a renewable source .Lobbying to continue with this scheme has not succeeded so far. This issue needs to be resolved to encourage renewable energy production. However, in NSW the State Government has introduced its own scheme called NSW Greenhouse Abatement certificate (NGACs) with a value of 1 tonne CO2 –e for low emission renewable energy. This is tradable and valued at AUD $ 12

Regulatory risks and market risks are high in Australia given that local issues are significantly less developed when compared to Europe and the temptation is to exploit the vacuum in the short term with poor solutions. However the risk manifests itself in subsequent years when the regulations catch up. The NSW Government has recently clamped down on some other industrial processors using their waste as 'fertilisers' to avoid disposal costs

Clients seeking services need to be informed so that they do not accept expedient solutions that lead to MBTs getting a bad name. This will be disastrous to the Industry. MBTs used generically for a variety of combinations of sorting, processing and sequencing of treatment have confused the customer and wrong conclusions can be made. While the proponent and their local agents may have done extensive due diligence, the decision makers (customers) often have limited information at their disposal to analyse the viability, benefits and risks associated. Proponents need to address this issue for them, the claims made must be capable of independent assessment.

3 Key market and regulatory risks in NSW

3.1 Contamination and stabilisation grades

- Australia has 3 routes for MBT outputs:
  - (a) Stabilised residue for Class 2 (inert) landfills
  - (b) Production of solid derived fuels (SDF)
  - (c) Production of compost products

  There are no definitive guidelines at present for all 3 in Australia.

- There are no criteria for landfilling or applications for the output (treated) material from a Mechanical-Biological Treatment facility in NSW. The only guidelines are the Compost standards AS4454 and the Use and disposal of Biosolids Guidelines. The AS4454 compost standards are a product of garden organics going through open windrow in ostensibly aerobic conditions and does not serve as a useful basis for MSW derived compost which has the presence of heavy metals. Consequently the Biosolids guidelines appears as the default standard. However the EPA are clear that they do not think that reliance on the Biosolids guidelines is suitable for land applications because AWT organics come from a diversity of waste normally not encountered in Biosolids. Local providers of MBT solutions are looking for more certainity for MSW type of compost and are trying to engage the EPA to develop practical guidelines both for land applications or landfilling. In NSW there is a draft Protection of the Environment Bill being prepared that may clarify matters relating to landfilling, fertliser or fuel applications. This is important legislation that will charter the course for AWT processes in NSW

3.2 Regulators have a wait and see position on MSW derived products

- There is uncertainty about what tests will be contemplated in the future by the EPA to determine organic content of the treated waste. This is because compost from some MBTs have a substantial percentage that will require landfilling either as biologically inert or putrescible. Traditionally, Total Organic Carbon (TOC), developed for the wastewater industry, has been used to measure the organic content. However, TOC tests are physical/chemical/thermal based and do not accurately provide biological characteristics of waste. The two analytical methods we are aware of are (a) the testing biological activity of MSW and/or waste derived solids using the Respiration Activity (AT_4) and (b) the fermentation test using (GB_{21}).
- We understand seven countries, including Germany have prescribed that after 2005 all waste must meet all requirements of table in Annex 1 (Table 2) and all MBT treated waste must meet all requirements of table in Annex 2 (Table 3). The remaining EU countries are expected to meet this target progressively by 2015. It is noted that the treated material should not only meet biological requirement (AT_4 of <5 mg O2 /g dry or GB_{21} of <20 l/kg dry) but also have a calorific value of <6000 kJ/kg. The Author supports something like this as the highest net resource value proposition for NSW or, alternatives like the market based instrument in the UK such as LATS which allows scope for adopting different MBT technologies and calculating the biodegradable diversion achieved. Such regulations create certainity for investment.
- In NSW organic waste material can be disposed as non putrescible if the specific oxygen uptake is less than 1.5 mg O2 /hour/gram total solids at 20°C or composted so that the mass in volatile solids in the organic waste has reduced in excess of 38% or composted for 14 days at an average temperature of 45 °C. The oxygen uptake is 30 times more than the European standards. As a result MSW compost is likely to satisfy the NSW benchmark for non putrescible landfill. Again in the author's view this under delivers if we are serious about reducing biological activity in landfills. This leads to poor MBT solutions being offered and accepted resulting in poor quality outcomes .

3.3 Key commercial risks

Distances, cultural and language differences make information transfer difficult especially when there are several issues to consider:

- Performance and reliability
  - How long has the technology been operating commercially
  - How has the technology been improved over the period
  - The performance of the reference plant or pilot plant
  - Has this technology the potential to be commercial and when
  - Has this technology better outcomes over others
  - What are the underlying assumptions that drive this technology
  - How is the data derived and have we got the correct information
- Footprint and Flexibility
  - What is the ecological footprint to processing volume demands

  - Will it satisfy the site specific requirements or do we need a new site
  - Is the process modular and in what increments
  - Is the process flexible to waste composition variation and if so how much and what additional processing will be required
  - What is the impact of the 1,2 or 3 bin collection system for the plant
- Utility needs
  - What are the electricity, fuel, water and wastewater needs
  - Is there sufficient information to do a comparative analysis with other technology options
  - Is the existing infrastructure able to handle this technology .If not what additional work is required and at what cost
- Beneficial use of products and marketability
  - Can we differentiate between beneficial use and marketability of products of different MBTs
  - Does MBT have weaker markets for soil amendments but stronger markets for renewable energy. If coupled with mechanical systems does the recyclables recovery rate improve
  - Are there contingency measures to overcome the regulatory hurdles now and in the future
- Volume and Quality of residuals that require Landfilling
  - What are the residuals
  - Can we fully market the products or should it be added to the residue in the interim
  - How do the residuals vary with waste characteristics
- Environmental performance
  - What are the emission levels
  - Are there potential emissions associated with the process. If so how do they vary between the various MBT configurations.
  - What are the emission characteristics of the wastewater discharge
  - What is the propensity for dust, odour and noise and how is it controlled
  - What are the greenhouse emissions and what is inherent in the process
  - What is the comparative water balance .Is water recycled and treated. Is it a net user or producer
  - What are the comparative noise and traffic impacts
  - Do the aesthetics utilise modern industrial architecture
- Estimated cost and economic growth
  - What are the project economics including capital, operating and maintenance costs. Is there sufficient information to make an assessment
  - What are the potential economic development opportunities i.e construction employment and permanent employee positions and secondary processing
  - The value for money proposition
- Experience of the provider
  - What is the provider's overall experience in the waste industry
  - What is the provider's specific experience with the technology
  - What is the provider's financial capability to deliver the project
- Partnership arrangements
  - What is the ownership preference i.e. publicly owned or privately owned
  - What is the project delivery mechanism
- Risk Profiles
  - What are the risk elements in the construction, schedule and performance

- Who bears the construction and technology risks
- What are the product sale and disposal risks
- What are the put and pay guarantees
- Can the project be financed
- How acceptable is the project to the public especially in relation to the technology type and siting
- What is the regulatory view
- What is the contingency plan

Despite the uncertainities, the author believes that risks can be mitigated. Progressing with MBT can only be beneficial on economic, environmental and social terms .While it can be argued that MBT is not the total answer to landfill diversion targets ,it goes a significant way towards it. WSN has introduced the first metropolition Sydney MBT plant at its Eastern Creek site in September 2004.

The technology (UR-3) from Global Renewables is described as follows:

- Initial removal of heavy and any hazardous items in the receival hall
- Mechanical separation using bag openers, trommels, magnets, eddy current, windshifting and manual separation. This recovers recyclables (over size). like metal, paper, glass and plastics
- A patented percolation (aerobic) process takes the mainly organic output (under size) from the mechanical separation process .Using processed recycled water and air, initial hydrolysis takes place. The organic liquid from the percolators is sent to a wet anaerobic digester to produce gas which is subsequently converted to electricity for internal use and export. The solid residues which are harder to break down in the percolators are dewatered and screened to send inerts to landfill or to the ADC (alternative daily cover) stream. The main output is sent to a composting hall where processed water is added to an intensive composting process for about 25 days. The final material is further maturated and secondary screened to produce Organic growth medium (OGM).Regulatory issues are being worked through concurrently on these products
- The plant operates under negative pressure and all off gases are treated through a bio filter

We are happy to report that this plant is 90% subscribed to its production capacity of 175,000 TPA.

4 Where to from here?

WSN has plans for further technologies for treating municipal solid waste to complement the UR 3R technology at Eastern Creek and provide flexible opportunities for our customer needs and requirements

4.1 Tunnel Composting

This non-proprietary, aerobic in vessel technology is well proven, can be used to stabilise MSW for landfilling, production of alternative daily cover (ADC) , rehabilitation compost or solid derived fuel.

4.2 ArrowBio Technology

This patented technology is the latest process using a wet anaerobic process. MSW from the receival hall is placed in a water vat .This system uses the water contained in MSW and recycled water from the 2 staged anaerobic digesters to provide a substantial liquid carrying capability to separate recyclables from the waste and provide material to the digesters. This wet MRF process is unique. It is a net producer of water that can be used for secondary use. Unlike some other systems that evaporate and then seek to use water in the composting process, the Arrow Bio process avoids the energy intensive drying stage. The separation of heavy and light fractions using density separation is unique. Lighter streams carrying plastic are further separated using an air separator. The heavier stream is screened and the use of magnets and eddy current recovers the ferrous and non ferrous items .All the system liquid flows into a secondary vat and passes through settling tanks to remove sediments. The suspension is sent to an acidogenic digester and subsequently to the methanogenic digester for the capture of methane which in turn is converted to electricity. The solid retention time in this process is 80 to 90 days which in turn enables a higher production of gas. The sludge from the anaerobic reactors can be further used for rehabilitation purposes.

5 Summary

The use of MBT in Australia is the preferred method by far for treating municipal solid waste and other organics. Given the availability of suitable material, the current tonnage commitments to AWT is less than 7% for this type of waste stream. Apart from Sydney, prices for landfill remain low, making investments unviable without government support. EPA regulators are at the early stages of preparing suitable guidelines and there is a growing lobby seeking market based instruments to assist the delivery of a sustainable outcome.

6 Literature

Professor P.W. Newman et. al	2001	Australia State of the Environment
Peter Maganov et. al	2003	New South Wales State of the Environment
European Commission	2001	Article1 Ordinance on Environmentally Compatible Storage of Waste from Human Settlements and on Biological Waste Treatment Facilities 2001/Germany

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