Improved Landfill Management

# Solid Waste Management Options and the Role of Landfilling



## Solid waste in WA

- 8.0 million tonnes of solid waste generated in 2020/21
- 2.73 million tonnes sent to landfill
- 435 landfills identified in 2017
- Although the proportion of waste recycled is increasing significantly, the amount of waste sent to landfill continues to rise by about 3% per annum



## Solid waste in WA

- Disposal of waste to landfill is the least preferred waste management option but will continue to be the primary method of dealing with waste that cannot be practically managed by any other means
- Best practice management of landfill is essential to ensure that todays landfills do not leave an environmental legacy for future generations



## Alternatives to Landfilling

Pre-treatment

Biological treatment

- Anaerobic decomposition
- Anaerobic digestion

Thermal treatment

- Incineration – burns waste to generate energy
- Pyrolysis – degrades waste with low level of oxygen, no combustion
- Gasification – heats and degrades waste in absence of oxygen

Bioreactor landfill

Waste to Energy



## Pre-treatment

Pre-compaction

- Practiced at some transfer stations
- Commonly by use of heavy machine/bulldozer on tipping hall floor
- Can significantly increase compaction and reduce air space usage at cell as waste is compacted against a hard surface

Shredding and screening of waste prior to landfilling

- Used in landfill mining, separates previously landfilled recyclables, reduces bulk
- Not yet used in Australia



## Alternative Waste Technologies

- Alternative Waste Technologies (AWTs) expensive to run
- Generally only viable when gate fees high ($130-$265/tonne) Incorporate composting and mechanical separation, may produce fuel stock or energy

| STATE | FACILITY | TYPE | OWNER | CAPACITY (TPA) |
|---|---|---|---|---|
| NSW | Global Renewables UR-3R | Composting MBT | Global Renewables | 220,000 |
| NSW | Kemps Creek AART | Composting MBT, two lines | SITA | 134,000 |
| NSW | EarthPower | Anaerobic digester for solids | Veolia ES, TPI | 50,000 |
| NSW | Raymond Terrace ARRT | Composting MBT | SITA | 40,000 |
| NSW | Spring Farm AART | Anaerobic digester for liquids | SITA | 10,000 |
| NSW | Biomass Solutions | Composting MBT | Biomass Solutions | 50,000 |
| NSW | Remondis OORT | Composting MBT | Remondis | 50,000 |
| WA | Mindarie BioVision ARRT | Composting MBT | SITA | 100,000 |
| WA | AnaeCo DiCOM | Anaerobic Digester + Dirty MRF | AnaeCo | 55,000 |
| SA | Process Engineered Fuel AART | Dirty MRF + Engineered fuel | SITA | 350,000 |
| QLD | Cairns Bedminster AART | Composting MBT | SITA | 125,000 |
| | | | *TOTAL* | **1,184,000** |

## Anaerobic decomposition

- Advanced Resource Recovery Technology (ARRT) Raymond Terrace, NSW (SITA, formerly Bedminster)
- Separate bin for recyclables
- Processes 40,000 tpa waste with sewage sludge
- Drum composter (3 days)
- Trommel screen separates inorganics and steel
- Compost windrowed on maturation floor (21 days)
- Further screened for glass and plastics
- Woodchip biofilter to manage odours
- 50% diversion of household waste from landfill



## Raymond Terrace ARRT



## Drum composter



## Maturation floor

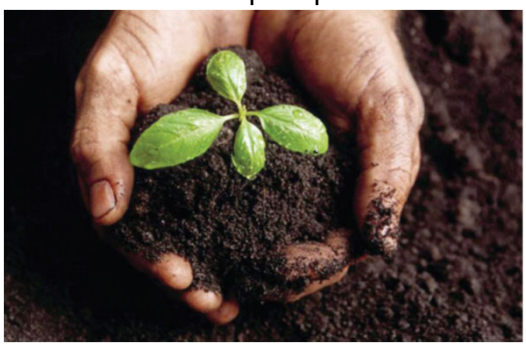


## Maturation floor



## Final product

## Final compost product





## Anaerobic decomposition

- Veolia Earthpower plant Camellia, Western Sydney, NSW
- Plant constructed initially for MSW but contaminated feedstock problematical – commercial failure
- Converted to Australia's first anaerobic digester for solid food organics
- Accepts “uncontaminated” organic solids from commercial customers (supermarkets, fruit and vegetable markets etc)
- Processes 50,000 tpa, 4-6 week digestion period in two 500m$^3$ digesters
- Produces pelletised fertiliser for garden use
- Biogas powers 3 x 1MW electricity generators



## Raw organic feedstock



## Screening out packaging



## Product screening



## Fertiliser product

## Methane biogas take-off




## EnerGen power generation



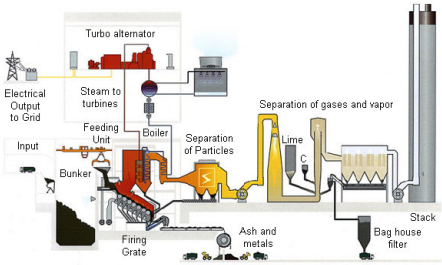
## Incineration

- Low temperature incineration produces significant adverse atmospheric impacts
- Low temperature incineration of plastics releases harmful dioxins
- High temperature incineration requires sophisticated flue gas scrubbing to prevent adverse atmospheric impacts
- Increasingly popular in Europe, reducing popularity in USA
- Not popular in Australia



## Incineration

- Waste to energy






## Dandenong incinerator

- Used for clinical waste (>1,000ºC)



## Pyrolysis

- Converts biomass to biochar and energy
- Suited to agricultural waste rather than MSW

## Gasification/Pyrolysis

- Brightstar SWERF Whytes Gully, Wollongong, NSW (1999)
- Multistage process – homogenise, pulverise and sterilise, separate recyclables, pyrolysis of remaining pulp for energy recovery
- Failed to achieve the anticipated performance and was dismantled after 4 years (2003)



## SWERF Gasifier



## Gasification facility - Germany

- Designed to process 225,000 tpa MSW
- Failed to meet emissions requirements
- Now closed



## Bioreactor landfill

- Wet landfill with leachate recirculation
- Designed and operated to enhance microbial degradation of waste and hence achieve stabilisation of landfill within a period of 20-30 years
- Operational example at Woodlawn, NSW



## Bioreactor landfill, Woodlawn, NSW

- ~1.0 Mtpa municipal waste from Sydney



## WA Waste to Energy Proposals

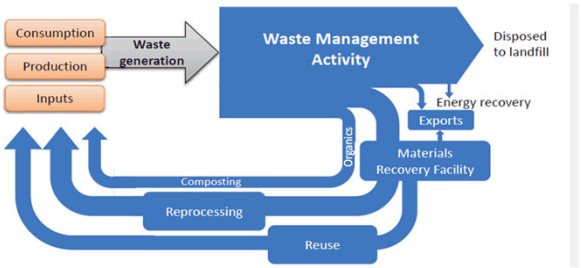
- Port Hedland: New Energy gained approval for a waste to energy plant in 2013
- Plant proposed plant for all types of waste through a materials recovery facility and to utilise the organic component to generate electricity through gas pyrolysis
- Close to road and powerline infrastructure
- Construction deferred

## WA Waste to Energy Proposals

- Kwinana, East Rockingham



## Waste generation and flow through the economy (ABS)






## Barriers to Alternatives to Landfilling

- Adequate landfill capacity
- Poor financial incentives
- Unfavourable public perceptions
- Lack of Government policy support
- Reliable access to feedstock supply
- Proximity to electricity grid
- Market for electricity, heat and Refuse Derived fuel RDF produced



## Alternatives to Landfilling

- All alternative waste treatment methods produce a residual waste
- Ultimately requires some landfill
- Alternatives have not made great inroads in Australia and then only near the major cities where available landfill airspace is limited and expensive. There remains need for landfill for management of a proportion of waste
- That proportion of waste is higher further away from the major urban areas