



AUSTRALIAN
EARTH
SCIENCE
EDUCATION

Solid Waste Management

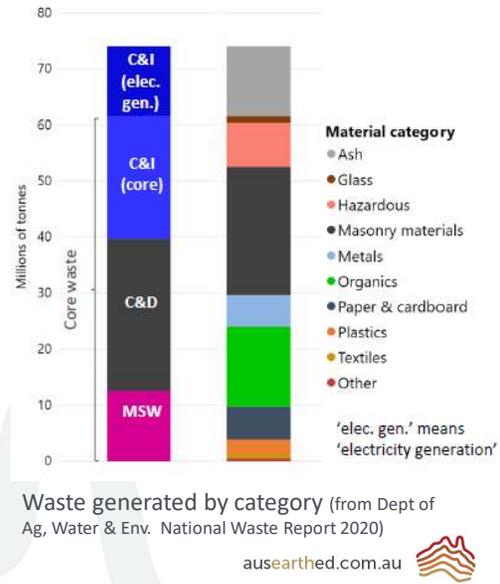
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What needs to be managed?

- 74.1 million tonnes (Mt) of waste in 2018-2019
 - 27.0 Mt construction and demolition (C&D)
 - 21.9 Mt commercial and industrial (C&I)
 - 12.6 Mt municipal solid waste (MSW)
- 2.94 tonnes per person



In 2018-2019 (reported in National Waste Report 2020), Australia generated 74.1 Mt of waste.

The most massive single type of waste was masonry (22.9 Mt) from the construction and demolition waste stream. The other major contributors were 14.3 Mt of organics and 12.5 Mt of ash from coal-fired power plants.

The amount of coal ash is about 500 kg per person per year. Most of this is stored in ash dams at power plants, although some (fly ash) is used as a substitute for cement in concrete.

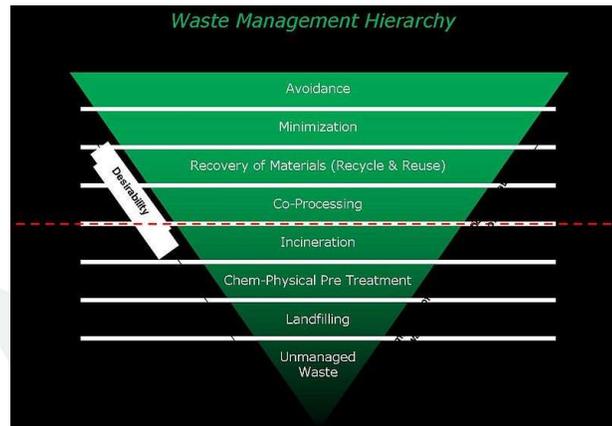
Information from:

Dept of Agriculture, Water and the Environment (2020). National Waste Report 2020. <https://www.environment.gov.au/protection/waste/national-waste-reports/2020>

Millington B (2019). Coal ash has become one of Australia's biggest waste problems – and a solution is being ignored. <https://www.abc.net.au/news/2019-03-10/coal-ash-has-become-one-of-australias-biggest-waste-problems/10886866>

What are the management options?

- Reuse
- Recycling
- Energy recovery
 - Landfill gas
 - Solid fuel
 - Waste to energy
- Landfill



(by GST HBK 2009, public domain)

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Avoidance and minimisation are the first steps in the waste management hierarchy. Once waste has been created, it must be managed by reuse, recycling, energy recovery or landfill. Each step down the hierarchy has more environmental consequences, which must be minimised.

Waste management is big business. In 2018-2019, \$17 billion was spent on waste services.

Information from:

Australian Bureau of Statistics (2020). Waste Account, Australia, Experimental Estimates. <https://www.abs.gov.au/statistics/environment/environmental-management/waste-account-australia-experimental-estimates/latest-release>

Reuse

- Requires no energy input
- Repair Cafés
- Garage sales and op shops
- Reuse containers and newspaper
- Soil



A garage sale (Jimmyjazz 2005, public domain)

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Reuse is the preferred waste management option because it requires no additional energy. We generate a lot of waste when we grow tired of items, outgrow clothes or no longer need products. These can be reused by others.

We tend to throw products away rather than repairing them and some products are made to be disposed of rather than repaired. Repair cafes aim to fix this problem by helping people fix their broken goods. Repair cafes prevented an estimated 420 000 kg of waste in 2019.

Reuse options include garage sales and secondhand shops, book swaps, using containers (jars, plastic tubs) for storage, using newspaper for pet bedding or garden mulch, etc. Charity shops divert about 600 000 tonnes of waste from landfill each year.

Soil excavated from one building site is generally used as fill on other sites.

Information from:

Repair Café (2020). Repair Cafés prevent 420 000 kilos of waste in 2019).

<https://www.repaircafe.org/en/repair-cafes-prevent-420000-kilos-of-waste-in-2019/>

Recycling

- 60% overall
- 90% of metals
- 82% of masonry materials
- 66% of paper and cardboard
- 60% of organics
- 59% of glass
- 47% of coal ash



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Although the overall recycling rate is 60%, this varies widely by materials. 90% of metals are recycled, but only 15% of plastic. Most plastic was sent to landfill.

Recycling opportunities are concentrated in urban centres, leaving regional areas with limited options for waste recycling and disposal.

Information from:

Dept of Agriculture, Water and the Environment (2020). National Waste Report 2020.

<https://www.environment.gov.au/protection/waste/national-waste-reports/2020>

Metal recycling

- Saves energy
 - 95% aluminium
 - 90% nickel
 - 84% copper
 - 75% zinc
 - 65% lead
 - 60% steel
- Eliminates need for mining (and mining waste)
- Need lithium recycling



Steel baled for recycling (blahedo 2004, CC-BY-SA-2.5)

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Large amounts of energy are required to mine and purify metals. This is particularly true of aluminium, which is extracted using electrolysis. Recycling aluminium takes only 5% of the energy required to produce it from ore – a saving of 95%. Metals are melted and re-manufactured to recycle them.

Recycling metals not only saves energy, but avoids mining waste. Mining waste is not managed by the waste resources industry. It is estimated that Australia produced 502 Mt of mining waste in 2018-2019. This figure dwarfs the 74.1 Mt of managed waste production. Most mining waste is tailings and is disposed of in dams at mine sites.

Our low-carbon future will require ever larger quantities of lithium for battery storage. At present, there is no significant recycling of lithium. This is a sector of metal recycling that needs to be developed.

Information from:

Norgate T (2013). Metal recycling: the need for a life cycle approach. EP135565, CSIRO, Australia.

<https://publications.csiro.au/rpr/download?pid=csiro:EP135565&dsid=DS2>

Other recycling

- Limited options for export
- Masonry recycling saves landfill space
- Composting organics
- Complicated sorting
- Coal ash



Compost heap at Kew Gardens (D Hawgood 2006, CC-BY-SA-2.5)

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In 2017, China and other Asian nations moved to restrict importation of material for recycling. This left Australia with the urgent need to develop recycling infrastructure. The government's Recycling Modernisation Fund is investing in infrastructure and manufacturers are committing to more recycled content in goods.

Masonry represents the greatest mass of any material in the managed waste stream. Recycling does not save energy relative to production but does save an enormous amount of space in landfill. This makes recycling worthwhile.

Composting organic waste has many benefits. In landfill, organic waste decomposes in an anaerobic environment, producing methane. Methane is a powerful greenhouse gas. When composted, organic waste becomes a useful soil additive and valuable trace nutrients like phosphorus and nitrogen are retained for plant use. Composting can be done on a small scale at individual homes or in large municipal composting facilities.

Most household recyclable material is placed in a mixed waste bin. This requires a sophisticated separation process involving electromagnets and optical scanners, as well as manual separation of inappropriate items.

Coal ash recycling is much lower in Australia than in other countries. Ash is stored in dams near power plants and frequently presents a pollution hazard for surrounding waterways and groundwater. The ash can be used as a substitute for cement in concrete manufacturing. This has the dual benefit of recycling waste and avoiding cement production (a greenhouse gas intensive process).

Information from:

Millington B (2019). Coal ash has become one of Australia's biggest waste problems – and a solution is being ignored. <https://www.abc.net.au/news/2019-03-10/coal-ash-has-become-one-of-australias-biggest-waste-problems/10886866>

Energy recovery

- 2.1 Mt of waste
- Landfill gas
- Waste derived fuels
- Anaerobic digestion
- Energy from waste



Baled waste-derived fuel (Fun4life.nll 2005, public domain)

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In 2018-2019, 2.1 Mt of waste was used for energy recovery. Most (82%) of this was recovery by landfill gas collection. Methane produced by anaerobic decay of organic material is collected and burned to generate electricity.

15% of energy recovery is from solid fuels made from waste. This is mainly from timber, plastics, paper and textiles. Occasionally tyres and hazardous wastes (solvents and paints) are used. Waste-derived fuels replace fossil fuels in cement kilns or industrial furnaces.

A small (4%) amount of energy is generated by burning methane generated by aerobic digestion of waste. This is common with wastewater treatment, but not widely used for solid waste. There are four plants that use commercially-derived food waste.

An energy-from-waste plant is being built in Perth and is due to begin producing power by the end of 2021. A proposed plant in western Sydney has met with great opposition from residents.

Information from:

ARENA (2018). Australia's first energy-from-waste plant to be built in WA.
<https://arena.gov.au/news/australias-first-energy-from-waste-plant-to-be-built-in-wa/>

Dept of Agriculture, Water and the Environment (2020). National Waste Report 2020.
<https://www.environment.gov.au/protection/waste/national-waste-reports/2020>

Skatssoon J (2020). Sydney energy from waste plant faces pushback.
<https://www.governmentnews.com.au/western-sydney-energy-from-waste-plant-faces-pushback/>

Landfill

- 37% (27.2 Mt) to landfill
- Biggest portions: ash, organics, hazardous waste and masonry
- Amount is declining, but not fast enough



Landfill compactor (2013, public domain)

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The 2018 National Waste Policy has set goals for waste reduction by 2030. The goal for landfill is to halve the amount of organic waste sent to landfill. Organics still represent a large proportion of landfill in 2018-2019.

The Plan also calls for reducing total waste generated by 10% per person by 2030 and increasing the recovery rate to an average of 80% for all waste streams by 2030. This is a challenge, as NSW is the 2nd highest per capita producer of waste in the world. The landfill capacity around Sydney is 2.1 Mt/year

Information from:

Dept of Agriculture, Water and the Environment (2019). National Waste Policy Action Plan.

<https://www.environment.gov.au/protection/waste/publications/national-waste-policy-action-plan>

Dept of Agriculture, Water and the Environment (2020). National Waste Report 2020.

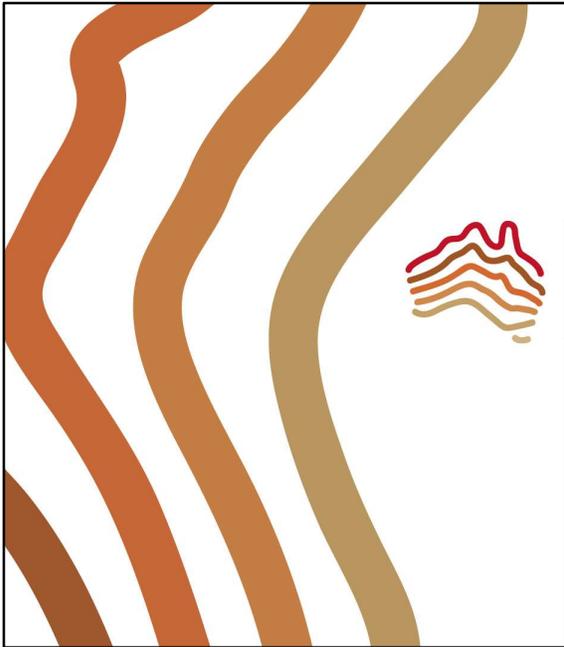
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- Australian Bureau of Statistics (2020). Waste Account, Australia, Experimental Estimates. <https://www.abs.gov.au/statistics/environment/environmental-management/waste-account-australia-experimental-estimates/latest-release>
- Dept of Agriculture, Water and the Environment (2019). National Waste Policy Action Plan. <https://www.environment.gov.au/protection/waste/publications/national-waste-policy-action-plan>
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