

Zero waste

In recent years waste managers have become interested in the concept known as zero waste, an approach which might at first seem ridiculous and impracticable. After all, basic laws of thermodynamics suggest that every process is wasteful, as nothing operates with one hundred per cent efficiency.

However, zero waste is more of a description of a basket of principles which, together, help society plan for the elimination of waste, rather than its management.

Zero waste seeks to:

- maximise recycling
- minimise waste
- reduce consumption
- ensure products can be re-used repaired or recycled back to nature or commerce

Taking the natural world as a model, living organisms consume resources and produce waste. However what is waste for one species is food for another so that within an ecosystem virtually all wastes are continually recycled, requiring only additional supplies of energy.

In theory at least, if one could design industry to emulate this pattern an industrial ecology would become established in which waste from one enterprise becomes the resource of another.

Zero waste can mean different things to different groups. For industry, waste prevention usually means cost efficiency and savings, and is an activity

within its own control. Supply chain issues can also be addressed, as a business can demand higher environmental standards from its suppliers. For local authorities, the issue is less clear. In many cases a municipality has little control over the lifestyles of residents, and simply provides a service. Education and encouragement needs to be subtle and protracted.

Zero waste policies

Zero waste policies have been tried around the world. Canberra, Australia became the first city in the world to set a vision of no waste by 2010, followed by US municipalities of Seattle, Del Norte County (California) and Santa Cruz County. More than one third of New Zealand's local authorities have set targets of zero waste to landfill. In 2001, Toronto, Canada adopted a policy of zero waste by 2010.

Many international corporations (eg Hewlett Packard, Bell Canada, Xerox, Kimberley Clark, Honda Motors and Du Pont) have also adopted ambitious zero waste targets.



The Ricoh Group claims to have achieved zero waste throughout its Japanese sites, and is on track to repeat this overseas by 2002.

These companies are reducing their waste disposal costs, and attracting customer loyalty through promoting sustainable business practices.

Case studies

Canberra

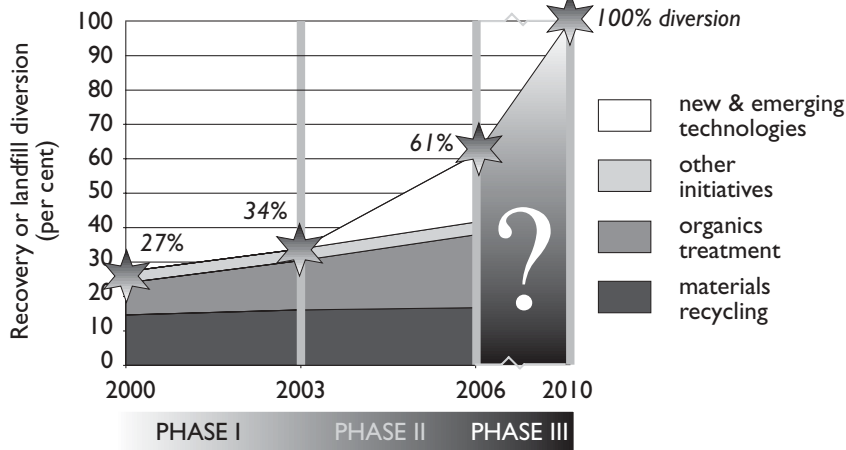
Canberra, Australia has developed a waste management strategy, after extensive consultation, to achieve a waste-free society by 2010.

Market development programmes have already generated jobs and businesses, (the re-use of demolition materials led to eight full-time jobs and the re-use of more than 100,000 tonnes of material).

The community-based recycling company Resolve salvages and sells goods from two landfills, supporting 30 jobs and recovering 7,000 tonnes material pa. Organic recyclers in Canberra compost in excess of 95,000 tpa garden waste. This has achieved a 39 per cent reduction in the total amount of solid waste sent to landfill. A framework for implementing zero waste in Canberra has been created based on the following steps:

- community commitment
- avoidance and reduction
- resource recovery
- residual waste management
- creative solutions

Figure 1 Toronto's Zero Waste by 2010 plans (assuming zero waste growth)



Toronto

Toronto, Canada has declared itself zero-waste by 2010. Waste disposal became a serious issue in 2000 when a new landfill contract (the present facility closes in 2003) suggested costs will rise from C\$12 to C\$52 per tonne.

In 2000, Toronto households created 920,000 t of waste, three-quarters of which was landfilled.

Toronto created a team (Task Force 2010) to pioneer the zero waste initiative, and it has established several targets:

- 30 per cent diversion by 2003
- 60 per cent diversion by 2006
- 100 per cent diversion by 2010

A closed-vessel anaerobic digestion facility is being built at a transfer station, biogas from which will be used to generate power. A hazardous household waste collection scheme has been instigated for

paints, varnishes, cleaning products etc (residents can collect these if they have a use for them). Five recycling depots have also been set up, along with an ambitious new approach to collecting and processing organics and mixed recyclables.

The largest opportunity lies in the collection of organics and their subsequent composting, as this stream accounts for 41 per cent of wastes presently sent to landfill. Net operating costs of the new system will be about C\$160 per household per year by 2006, which compares closely with the status quo.

Table 1 (above, left) shows the rapid improvement needed in Toronto's resource recovery (and landfill diversion) performance, to lift the city from current levels of 27 per cent to 100 per cent in only nine years. Toronto's forecasts are based upon several assumptions. In Toronto's case, resource recovery rates are based on tonnages generated in 2000, not 2010. If waste

arising in Toronto do not remain constant over time, then landfill diversion rates will be reduced proportionately.

DuPont

This chemical and synthetic-fibre manufacturer has adopted the corporate motto the goal is zero, encompassing zero injuries, illnesses,

incidents, wastes and emissions. The company succeeded in setting a series of business goals within the concept of sustainable development, based on elimination of all wastes and emissions and on conservation of energy and natural resources.

Company-wide goals for 2010 include:

- from 1990 base levels, a 65 per cent reduction in greenhouse gas emissions
- ten per cent renewable energy sources
- 25 per cent of revenues from non-depletable resources

One of DuPont's larger older plants in Mexico City is almost at zero in waste and emissions. The company is also pushing for the zero principle to be incorporated into value partnerships with customers and suppliers. For example, in a deal with Ford, DuPont Canada agreed to trade the number of cars painted rather than gallons of

paint. Costs to Ford were reduced and waste volumes cut - Ford achieved cost savings of 35 - 40 per cent and volatile organic compound emissions were cut by half.

Zero emissions project Leicestershire, UK

A small brewery in Leicestershire, UK was chosen as a test-case for zero emissions project. One of the main waste streams produced by the brewery is spent grain (the first is water). For every barrel of beer produced, 24kg of spent grain is produced as waste.

The overall aim of the project was to test the feasibility of:

- growing high quality mushrooms using the spent grain
- using the spent mushroom substrate as an animal feed
- generating energy from the animal manure
- using the energy elsewhere in the process

The study confirmed that such a brewery would be possible, economically and technically.

The main problem in setting up such a system in the UK would be the relocation of the various industries to form a cluster, for example it is unlikely that a large brewery would be allowed to relocate to a suitable rural location under the present planning system. It is more likely that a micro-brewery might be established on an existing farm. Also, it is clear that the total output of exotic mush-

Zero Waste

- aims to eliminate rather than manage waste
- a whole-system approach to change the way materials flow through society
- an end-of-pipe solution which encourages waste diversion through recovery, and a guiding design philosophy for eliminating waste at source and throughout the supply chain
- a unifying concept for a basket of existing and emerging technologies to eliminate waste
- a way to transform the current cost-plus waste industry into a value-added resource recovery industry
- re-designs one-way industrial systems into cyclical system modelled
- helps communities achieve a local economy that operates efficiently, sustains good jobs, and provides a measure of self-sufficiency
- maximises recycling, minimises waste, reduces consumption and ensures products are made to be re-used, repaired or recycled back into nature or the marketplace

Source: Zero Waste New Zealand Trust (2001)

New technology for zero waste

Recycling and re-use initiatives have helped resource conservation, but the results are clearly insufficient. New technologies may play an important role in extending zero waste principles, and paper production in China provides an illustration.

There is a strong demand for paper in China, but with limited space and water supplies there is insufficient land available for re-forestation and sustainable forestry, and traditional hard and soft-wood resources cannot respond to demand. China is presently reducing its own forests and is also importing pulp and waste paper.

However, two major sources of cellulose are not currently efficiently exploited in China, rice straw and bamboo. Rice straw is abundant and fast-growing and is harvested once or twice a year (fast-growing softwoods require seven years' growth).

Extraction of cellulose from rice straw involves the use of alkali sulphates which recovers only 13 per cent of the available cellulose; residues are toxic waste. Alternative technologies of steam extraction and membrane filtration could increase the yield from 13 to 83 per cent.

Bamboo is also suitable for treatment by this method, yielding a hemicellulose (a sweetener), and lignin (a fuel or binding agent for particle board).

rooms from a single brewery would be equivalent to a third of the total UK market, and such a large volume would possibly depress prices in that market.

Timaru, New Zealand

Timaru District Council adopted an in-house zero waste policy in February this year. Within just three months the programme has recycled 1700 kg of paper and achieved a waste reduction total of 83 per cent. The local public health office has also adopted a zero waste plan and reports a reduction in waste to landfill of 85 per cent.

The Whakatane District Council adopted a zero waste policy a year ago and made a decision to invest NZ\$1.6 million in a resource recovery centre instead of a new landfill facility. The existing landfill is being closed to the public and all bulky wastes, end-of-life vehicles and greenwaste will be diverted through to the resource centre.

It is estimated that wastes to landfill will be reduced by 50 per cent overall. In addition, two holiday parks in New Zealand have introduced full recycling facilities where visitors are asked to separate all wastes into 300 litre plastic drums discarded from the kiwi-fruit industry.

Waste disposal costs have been reduced from NZ\$100 to NZ\$12 over the last Christmas holiday period and income has been generated from the sale of aluminium cans.

Conclusion

In recent years legislation across the world has implemented various policies designed to reduce, re-use and recycle waste, and have promoted the polluter pays principle.

Industry is being forced to clean up end-of-pipe wastes, but these strategies are proving to be inadequate against the rising tide of waste.

To go further down the road of sustainability, countries must go beyond this regulatory approach and change from a highly competitive free market to one in which companies cluster together and co-operate in order to share wastes and gain added-value.

The principle of zero waste unites environmental sustainability, community sustainability and economic sustainability. It includes the principles of conservation of resources, minimising pollution, growing local employment opportunities and economic self-reliance.

Zero waste is more of a journey than a possible destination, it describes an aspiration which seems broader than waste prevention.

Perhaps, as with sustainable development, the concept has its greatest benefit in helping identify the path to the better uses of resources within society.

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Warmer Bulletin is published by Residua, a company formed to provide world-wide information on sustainable management of municipal solid waste.

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