

MANAGEMENT OF WASTE IN CITIES – A DECISION-MAKING EXERCISE

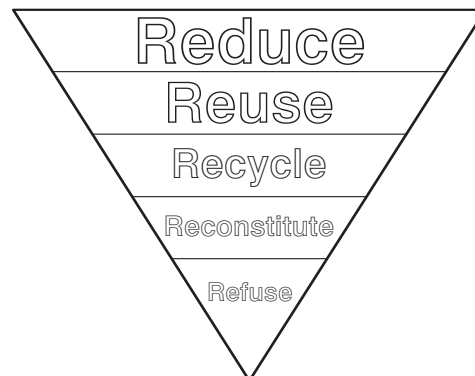
There is nothing new in the notion that human activity – particularly when concentrated in urban environments – can produce large volumes of waste. What has changed in recent years is that in simple terms, society generates more waste now, with a greater potential toxicity, and having a greater longevity, than ever before. According to the most recent figures available, Britain generated 335 million tonnes of waste in 2004 (Department for the Environment, Food and Rural Affairs (Defra)). But such a statistic needs to be treated with a degree of caution. The alarmists would point to the fact that, at such a rate, Britain generates enough waste every hour to fill the Albert Hall (Sunday Times, 10 March 2002). However, this total includes 100 million tonnes of minerals waste from mining and quarrying, with a further 190 million tonnes arising from construction, industry and business. Only 30 million tonnes per year is produced from domestic sources – equating to approximately 517 kg of waste per person per year. This is still a significant level of waste; a level which the European Union and the British government are both resolved to reduce.

The purpose of this **Geofile** is to provide an understanding of the current debates regarding waste management, with a particular emphasis on what can be done to reduce the ecological footprints of urban environments. It will focus on individuals as well as communities, while the legislative framework applying to industry and business will also be explored. Students will then be in a position to weigh up the competing arguments, and will be shown the significant cumulative impacts that personal choices can bring.

The waste hierarchy

With increasing media interest in environmental affairs, more and more people are becoming aware of the fact that good practice, in waste management terms, consists of a hierarchy of possible choices. The least favoured option, though most widely used at the current time, is for

Figure 1: The waste hierarchy



waste to be landfilled (in 2005/6, 73% of household waste was treated in this way, according to Defra). Ideally the other options in the waste hierarchy would be fully explored and exploited before disposal was the only remaining option (Figure 1).

Reduce

The most significant contribution to managing the production of waste can be made by stopping it occurring in the first place. This particularly applies to businesses and consumers – both groups are being encouraged to reduce the volume of packaging associated with products. A government-funded environmental group, Envirowise, specialises in providing free advice to commercial enterprises, and claims to have succeeded in saving its clients more than £1 billion since 1994 through environmental initiatives. Consumers can play a part in the reduction process by opting for products that do not use excessive packaging (not always easy to achieve in practice) or by simple measures such as refusing plastic bags at the checkout. According to a recent report in the Guardian, every person in the UK uses up to 280 plastic bags per year – in this case politely saying ‘no, thank you’ could go some way to reducing the 17 billion annual total for the UK alone. In Ireland a 0.15 euro charge has been levied on plastic bags since 2002, which has resulted in a 90% decline in their use (no such legislation exists in the UK, but the furniture company IKEA, amongst others, has introduced a scheme to charge 10p per bag, also resulting in a 90% fall in demand).

Re-use

The introduction of voluntary or mandatory schemes to charge for plastic bags also has the effect of achieving the second priority on the waste hierarchy. Consumers are encouraged to make successive use of the same product, not reconstituted in any way. Milk bottles, certain soft drink bottles, even jam jars provide a further example – all that’s needed is for them to be cleaned before being put to another (or similar use). Many retailers sell ‘bags for life’, encouraging their use through cash rewards at the till, while in the USA many states operate a scheme for mandatory cash deposits on glass bottles. This cuts down the onward waste stream, while at the same time allowing the consumer to achieve high levels of waste reduction (see above). Measures such as donating used items to charity shops, or doing the same thing online (<http://uk.freecycle.org/>), also go some way to reducing the demand for new products.

Recycle

In a recent survey, conducted by the Local Government Association’s (LGA) environment board, 85% of those questioned claimed that they participated in recycling. Latest figures from Defra show that only 26.7% of all household waste was recycled in 2005/06 – an indication that not all the LGA questionnaire respondents were telling the truth. It does suggest, however, that a high proportion felt that they ought to be supporting recycling initiatives. Even so, the UK’s recycling rate is significantly below that of many of its EU neighbours, and falls short of the 40%

Box 1: Recycling revisited

Householders participating in recycling schemes take satisfaction from the fact that, in their own small way, they are contributing to a more sustainable future for the planet. There is some justification for such a view – one UK company based in Kent produces 1% of the world's newsprint from recycled newspapers and magazines, for example – but there is certainly no room for complacency. After all, less than 10% of all waste generated in the UK comes from household sources, meaning that the majority of the recycling challenge relates to construction and manufacturing, rather than households. This would explain the fact that, despite UK households recycling almost 160,000 tonnes of food and drink cans in 2005, this amounted to less than 2% of all ferrous scrap recycled in the UK that year. In any case, in terms of sustainability of production, many products come from raw materials that are almost ubiquitous (paper can be made from managed forests, glass from sand, and steel from large reserves of iron ore).

There is, however, a quantifiable environmental cost involved in recycling household waste. Even before the processing can begin, there is considerable energy consumed (and hence, carbon dioxide emitted) in driving the products to the recycling centre, its subsequent collection by local authorities and onwards transfer, and the necessary hot water cleaning that has to take place.

The paper industry provides another example where recycling might not be as advantageous as first thought. Leaving aside the bleaching agents and other chemicals required in the recovery process, there is the issue of where the paper was sourced from in the first instance. If, as in the UK, much of the paper derives from Scandinavian suppliers who make use of renewable energy in its production (e.g. hydro power), then it may make more sense to burn waste paper in energy-from-waste (EfW) plants, rather than recycle it. In this way you could reduce the amount of coal demanded for local electricity generation and thereby reduce overall carbon dioxide emissions.

recycling rate that will be needed to meet EU waste targets by 2010.

Recycling is an effective means of reducing the onward waste stream and, in certain cases, can result in significantly reduced energy demands. This is particularly the case with aluminium drinks cans, which require only 5% of the energy of the original smelting of bauxite in order to be reconstituted. The attractive economics also means that scrap steel

Box 2: Text of Daily Mail article (abridged)

HOMEOWNERS FACE A TAX ON THEIR BINS

By STEVE DOUGHTY 5th October 2006

'Pay-as-you-throw' wheelie bin collections that will see families charged for their rubbish are to be introduced nationwide, it has been revealed. Town hall chiefs are planning the rapid introduction of schemes across the country that will work through microchip-equipped wheelie bins. The plans mean every household will get a rubbish bill based on its waste left for collection, in an attempt to encourage recycling.

Town halls said yesterday that they will cut council tax bills when rubbish bills are brought in. But critics warned that the overall cost to homeowners – and in particular families who produce the most rubbish – will be much higher under the new scheme.

And opposition politicians warned that the pay as you throw system – styled as a way of making the polluter pay – will encourage widespread fly-tipping and dumping of rubbish in neighbours' bins. The announcement of the imminent introduction of a pay by weight system came as it was disclosed that almost one council in ten of the 330 local authorities is now planning to put computer microchips into wheelie bins. More than 30 are known to be organising chips in their bins.

Half a million wheelie bins equipped with microchips are already believed to be in use by councils including South Norfolk, Devizes in Wiltshire and Woking in Surrey.

The row over wheelie bins and 'pay as you throw' comes amid growing controversy over council attempts to force households into recycling more of their rubbish. Demands that people put different kinds of rubbish in different bins – sometimes to the extent that householders are required to tear the cellophane windows out of envelopes – have provoked protests.

There has also been rising discontent over councils that drop weekly waste collections as part of their recycling programmes. The new bin schedules mean some waste goes uncollected for as long as a fortnight – with householders threatened with fines of up to £20,000 for leaving bin bags out on the wrong day.

Such heavy fines are aimed at fly-tippers and at deterring people from dumping rubbish – but the fines set out in new laws also catch those who simply put out their own rubbish too early.

Environment Minister Ben Bradshaw said in the summer that they would look sympathetically at a pay as you throw plan. He said: 'People who don't recycle are costing their neighbours more by pushing up their council tax, and also contributing to climate change. It is time people realised that. Variable charging does work in other European countries.'

is almost always recycled, and it is becoming increasingly profitable to recycle paper. The effective recycling of plastics, however, is difficult to achieve on a profitable basis – despite the fact that the technology exists to produce fleece jackets from plastic bottles (25 bottles make one adult-size jacket)! In cases where recycling is possible, but not commercially viable, it is up to the government to subsidise activities until a profitable market can be established (this is exactly what happened with recycled paper).

Reconstitute

Reconstituting waste is the final alternative before the only remaining option, landfill. Most frequently this involves incineration, with the UK disposing of 9% of its municipal waste in this way (compared to a European Union average of 17%, rising to over 55% in Denmark). When maintained at the correct temperature, and supplied with a controlled feedstock, incinerators are able to reduce the volume of waste to 30% of the original

input while at the same time providing electricity and hot water to nearby properties. Campaigners claim that incineration entails an unacceptable risk of pollution, both from the chimney emissions and from the residual ash left at the end of the process. Biomagnification also occurs, with many harmful substances concentrating in the ash, especially dioxins (from plastics and PVC), that then need to be sent to landfill or treated in a subsequent process known as vitrification (where the dioxins are burned off and the residue becomes glass-like and can be used as road building substrate). Supporters of incineration would argue that technology has reduced the risk of onward pollution to a negligible level, and that the considerable protests that invariably greet new development plans are motivated by NIMBY interests and ignorance. The Environment Agency is keen to stress that it undertakes vigorous monitoring of the 17 licensed municipal incinerators in the UK,

Table 1: Regional household recycling rates 2000/01 to 2005/06

Region	percentages					
	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
North East	4.1	5.2	6.6	12.2	15.4	21.1
North West	7.5	9.2	11.3	14.2	19.2	23.8
Yorkshire and the Humber	7.3	8.9	11.2	14.5	18.6	21.8
East Midlands	13.1	13.7	15.1	19.3	26.3	31.8
West Midlands	9.1	10.2	13.0	15.7	19.9	25.1
East	15.2	17.4	19.4	23.4	29.8	34.1
London	9.0	9.3	10.9	13.3	17.6	20.7
South East	16.4	17.7	19.6	22.8	26.1	29.2
South West	14.9	16.6	18.6	21.4	26.6	31.4
England	11.2	12.5	14.5	17.8	22.5	26.7

Source: Department for Environment, Food & Rural Affairs

and their figures show that all measured emissions have been considerably reduced since 1990. There can be no denying that this method has been associated with significant pollution incidents in the past, however. Between 1993 and 1996 more than 2,000 tonnes of highly toxic material from the Byker incinerator (now closed) was mistakenly spread around allotments and footpaths by the Newcastle City Council, while an incinerator in north London forwarded contaminated ash to be processed into breeze blocks for the construction industry. The local siting of incinerators also tends to reinforce the multiple deprivation experienced in some of the UK's poorest neighbourhoods. Lacking an effective political voice, such communities are unable to resist these schemes, which subsequently contribute to the indicators of poor health and welfare experienced in the area in any case. This provides another example where those in society least able to cope are forced to live in the most hazardous environment. Even with stringent pollution controls in place, there seems to be an inverse logic in building incinerator plants (each costing upwards of £100m) which then need a guaranteed supply of waste feedstock in order to remain in operation. Certainly it is unlikely that any local authority would be keen to promote alternative waste strategies that risked putting an expensive incinerator scheme out of business.

It is also possible to reconstitute the waste stream represented by municipal sewage. Filtration systems enable much of the water content of sewage to be treated and then released back into the environment, but this leaves a residual sludge which needs to be disposed of. In recent years the organic value of this sludge has come to be recognised, and a number of schemes have demonstrated that pellets made of dried sewage residue can be used successfully in a variety of schemes. For example, a cement works in Derbyshire uses sewage sludge pellets as a form of biomass fuel in its kilns, and reckons that ten tonnes of sewage provides the same energy as six tonnes of coal. In South Yorkshire, trials have been conducted into reclaiming colliery tip heaps using sewage sludge pellets in the soil, and the results have yielded much healthier growth than traditional restoration schemes. In this sense, the reconstituted material is helping to 'recycle' old industrial areas.

Landfill

Despite being the least environmentally sound option, at least 73% of UK household waste is currently buried in landfill each year. Notwithstanding the considerable environmental hazard posed by disposing of waste in this way, it is now apparent that this option will soon no longer be available: in October 2006 it was reported that the UK had capacity for only 9 more years of landfill before significant localised shortages of available sites begin to occur.

Furthermore, EU legislation now in place binds the UK to reducing the amount of municipal waste sent to landfill to 75% of 1995 levels by the year 2010 (Table 2). There are also more stringent guidelines in place regarding the physical siting and structure of landfill (particularly with regard to preventing pollution from toxins leaching into groundwater supplies, as well as managing the generation and harnessing of methane gas).

The combination of these factors means that landfill is becoming an increasingly expensive waste option, and there is a growing interest among local councils in so-called 'pay-as-you-throw' schemes. In this way each household will be charged according to the volume of waste that they produce (either weighed in high-tech wheelie bins or through purchase of special refuse collection sacks). The difficulties inherent in making such schemes successful can be seen in Ireland, where household charging has been enforced since 2003.

Anecdotal evidence suggests that rates of fly-tipping and burning of domestic waste have increased since the introduction of the polluter-pays principle, with consequent impacts on the health of the population. In the UK there has also been a rise in illegal dumping and incineration – even without the introduction of household charges. A series of undercover television reports have shown the ease with which unscrupulous businesses are able to flout the law, and the competitive

Table 2: Key UK waste targets (based on EU legislation)

<p>Waste Strategy 2000 recycling targets</p> <ul style="list-style-type: none"> a) 25% of household waste to be recycled or composted by 2005. b) 30% of household waste to be recycled or composted by 2010. c) 33% of household waste to be recycled or composted by 2015. <p>Waste Strategy 2000 recovery targets</p> <ul style="list-style-type: none"> a) 40% of municipal waste to be recovered by 2005. b) 45% of municipal waste to be recovered by 2010. c) 67% of municipal waste to be recovered by 2015. <p>European Union Landfill Directive targets</p> <ul style="list-style-type: none"> a) Biodegradable municipal waste to be reduced to 75% of that produced in 1995 by 2010. b) Biodegradable municipal waste to be reduced to 50% of that produced in 1995 by 2013. c) Biodegradable municipal waste to be reduced to 35% of that produced in 1995 by 2020.
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advantage of unregulated sites will only increase as other taxes and charges accumulate.

The experience of Japanese municipalities serves as reassuring evidence that public attitudes to domestic waste can be changed. Operating a system of staggered collection (depending on waste type) which is so complex that most people need a special waste calendar, domestic waste is effectively monitored and managed, assisting the local authorities with their disposal choices. Residents must make use of colour-coded refuse sacks (£1.50 for a pack of ten), the translucence of which allows waste collectors to scrutinise the content. Heavy fines for non-compliance ensure an extremely orderly and efficient system is operated.

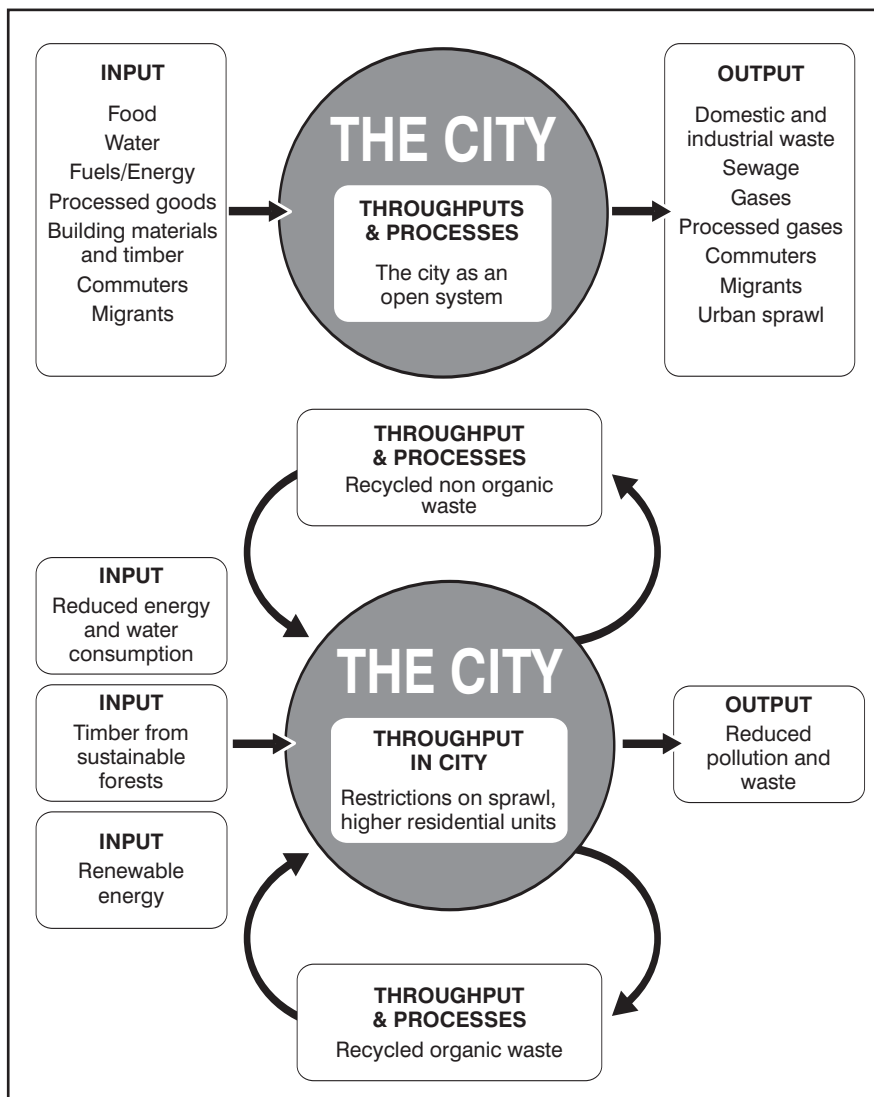
The urban dimension

Waste is generated from human activities, and cities represent the most significant concentrations of population. This poses challenges, in that urban areas are consistently the most prolific generators of waste, but offers opportunity in that education and reform can more easily be effected in such clearly defined areas. On a global scale it is also worth noting that the volume of urban waste generation is extremely sensitive to income levels – generally, the richer the city, the more it will consume, and hence it will produce more refuse. Levels of waste recovery tend to follow an inverse pattern, with cities such as Cairo in Egypt (with the Zabbaleen) and Curitiba in Brazil setting the standard for levels of re-use and recycling. Cities are also the hubs of creativity, learning and innovation,

meaning that new approaches to waste often derive from their citizens (eg washing machine portholes reclaimed as kitchen bowls, the drums as stackable storage units, and the ball bearings as bicycle parts!).

Cities are also able to change their metabolism. This idea is attributed to Herbert Girardet, who proposed the argument that cities are basically like living organisms which need inputs in order to operate, are then enabled to perform a number of functions, before ejecting outputs in the form of waste. Early cities were biogenic by nature, in that they needed to subsist for the most part with materials from the immediate surroundings. As a result, great care was taken of the productive capacity of surrounding land, with human and animal waste routinely added to the fields as fertilizer, and land management practices employed that aimed to sustain local resources indefinitely. This model of a circular metabolism therefore succeeded in minimising the level of inputs while maximising the re-use of outputs (see Figure 2). The linear urban metabolism, on the other hand, makes use of technology and transportation to bring in a volume

Figure 2: The city as a system



of inputs that totally surpasses the ability of the local environment to provide it, while paying scant heed to the long-term viability of its output stream. Girardet warns that, on a global scale, urban civilisation risks succumbing to the same fate as befell the ancient cities of Ur and Babylon, when they, too, exceeded the natural environment's ability to provide for their needs and cope with their waste.

Quantified in terms of ecological footprint, as was researched for London in 2002, it is apparent that Girardet's predictions may not be too far wide of the mark. The London survey found that the city's ecological footprint covered an area twice the size of the UK, and that if the entire population of the world made such demands, we would need at least three planets to sustain this level of activity. Clearly action was needed, and the Greater London Authority is now committed to trying to realign London's urban metabolism. As a result of a 2003 publication (*Rethinking Rubbish in London*), a Green Procurement Code was adopted by all London boroughs (as well as a further 230 leading organisations in London), the main aim of which was to set a leadership role in encouraging the purchase of recycled products. Emphasis was placed on increasing public awareness of environmental issues through the publication of leaflets and the creation of online resources dedicated to tackling London's waste issues. One of these sites points out that at present, most of London's municipal waste is sent for landfill outside of the capital, and that almost 70% of this is transported by road – a doubly unsustainable state of affairs.

Arguably the fiscal and legal powers enjoyed by the Greater London Authority ought to empower the capital to take bold steps to reduce its waste generation, though the Mayor was recently rebuffed in his plans to establish a single waste authority for London to take over the role of the local boroughs (July 2006). It could also be argued that his current focus is more on traffic management issues.

Think globally, act locally

Every year in the UK, when the Queen's Christmas broadcast comes to an end, power companies across the country experience a surge in demand for electricity as millions of people simultaneously switch on the kettle to make a cup of tea. One of the largest such surges, of 2,800 megawatts, came after the World Cup penalty shoot-out against Germany in 1990. On a local scale, very few people would give a second's thought to making a hot drink; but taken collectively, the actions of a large number of people can have a dramatic effect (indeed, were it not for careful planning by the National Grid, there would be frequent power outages for just this reason). In a sense, the same rationale can be brought to bear in the question of urban waste. If, at an individual level, a concerted effort were made to adhere to the preferred options in the waste hierarchy, then achieving future waste management targets would be easy; and the environment would be the better for it. If not for altruism (doing something for the good of the wider environment, the benefits of which you won't immediately see), or pragmatism (the realisation that current waste behaviour is unsustainable), then it may be down to capitalism to ensure that targets are met. Personal taxes (pay-as-you-throw), coupled with a mixed bag of government fines and fiscal incentives, might just achieve success.

Table 3: Waste generated per capita in different cities

City	Waste generated (kg/capita/yr)
Bangalore, India	146
Manila, Philippines	146
Mexico City, Mexico	248
Vienna, Austria	431
London, UK	452
Paris, France	522
Sydney, Australia	1,030
New York City, USA	1,100

Decision-making exercise

1. Why is Figure 1, The waste hierarchy, drawn as an upside down triangle?
2. (a) Describe the pattern of household recycling rates between 2000 and 2006 (Table 1).
(b) What are the benefits and difficulties of households recycling their waste? (Box 1, general text).
3. Assess how UK government and EU targets for waste management will affect:
(a) local authorities;
(b) individual households (Box 2, Table 2, general text).
4. To what extent do you find a systems approach appropriate to urban waste management? (Figure 2 and other resources).
5. What more could the Mayor of London (or any other local authority) be doing to reduce the volumes of waste produced? Develop current policies, as you see them. What will be best for the future? You decide!

Sources

<http://www.defra.gov.uk/environment/waste/index.htm>
<http://www.defra.gov.uk/environment/waste/about/index.htm>
<http://www.defra.gov.uk/environment/statistics/waste/kf/wrkf02.htm>
<http://www.defra.gov.uk/environment/statistics/waste/index.htm>
http://en.wikipedia.org/wiki/Main_Page
http://www.wearewhatwedo.org/do_something/actionlisting.php
<http://uk.freecycle.org/>
<http://www.aylesford-newsprint.co.uk/Students.asp>
<http://www.capitalwastefacts.com/>
<http://www.recycleforlondon.com/index.cfm>

Herbert Girardet, *The Gaia Atlas of Cities (New directions for sustainable urban living)*, Gaia Books 1996.