September 2002

Friends of the Earth

Briefing

Maximising recycling rates – tackling residuals

Background

Friends of the Earth is an international organisation with over 70 member groups across the World. The majority of these groups are in developing countries. Because of this, Friends of the Earth has first-hand knowledge of the huge social and environmental damage caused by the extraction of resources, for example by the forestry industry or the mining industry. The majority of these resources are used once in rich developed countries, such as the UK, and then simply thrown-away in landfill or incineration. The impact of our throw-away society goes way beyond the borders of the UK. The environmental and social impacts of the UK's resource consumption far outweigh the impacts from waste disposal back home [1]

Friends of the Earth argues that the UK must maximise resource efficiency and minimise waste. At the moment the UK has an appalling record on resource use and recycling. This is why Friends of the Earth supports and promotes the concept of zero waste. Zero waste from households, zero waste from commerce and zero waste from industry.

Friends of the Earth, 26-28 Underwood Street, London N1 7JQ
Tel: 020 7490 1555 Fax: 020 7490 0881 Email: info@foe.co.uk Website: www.foe.co.uk

Friends of the Earth Limited company number 1012357
♻ Printed on paper made from 100 per cent post-consumer waste

The path to zero waste is not a simple one. It requires a different way of thinking and it requires new legislation (for example on product design). But it is possible and it is necessary. Consumption of the World's resources needs to be reduced to prevent breaches of environmental limits but at the same time developing countries need to increase their resource use to develop and reduce poverty. The rich wasteful countries of the North need to reduce resource consumption by 80-90 per cent over coming decades.

This short briefing outlines the key findings from research conducted for the Community Recycling Network - funded by Friends of the Earth and Biffaward - on how we can maximise recycling rates from household waste and how we can best deal with the residuals as we move towards zero waste in this sector.

Maximising recycling

This part of the research was based on data from local authority wide recycling schemes in England and other parts of Europe. The researchers have generated estimates for how much England could recycle on average if all local authorities delivered current good practice in England. It also uses experience from Europe to suggest what could be achieved if European good practice were implemented across England.

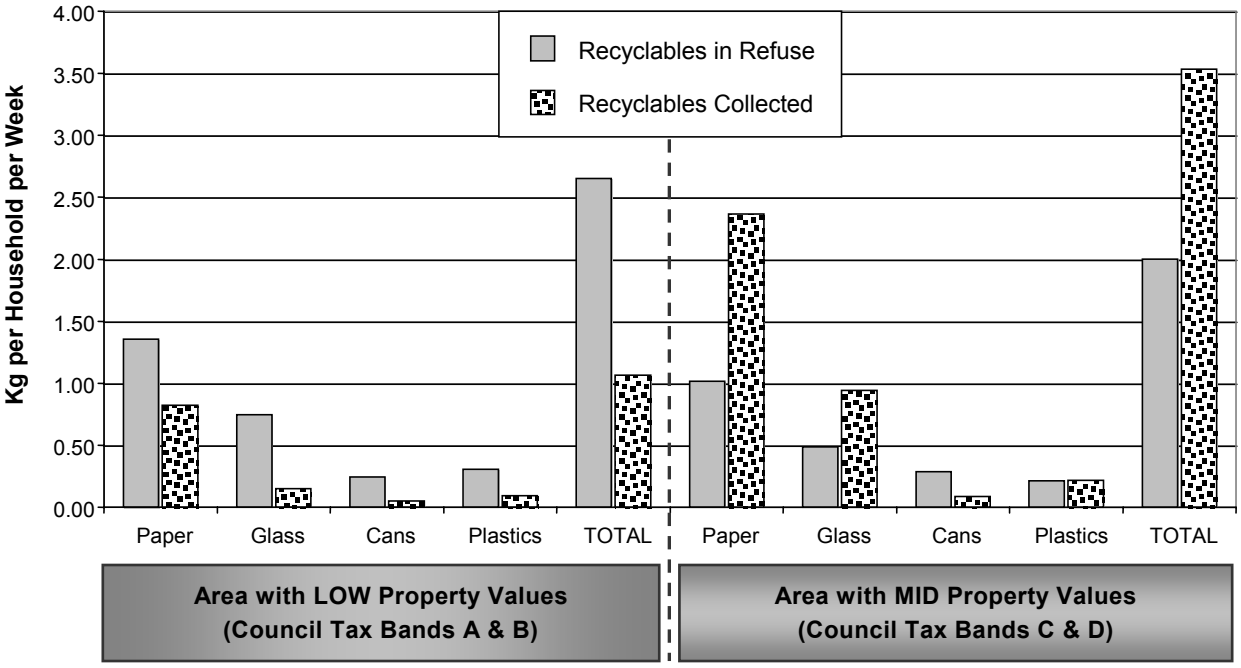
It suggests that:

- Highest recycling rates are achieved by providing a doorstep collection service.
- Providing a container and a weekly collection improves participation.
- The separate collection of food waste for composting or anaerobic digestion has the biggest potential for improving overall recycling rates.
- Reducing the size of the bin for residual waste can improve recycling rates, as will reducing collection of residual waste to fortnightly (although for the latter it suggests householder agreement is important).
- If garden waste is collected it should be collected separately for composting or anaerobic digestion.

Taking poverty into account

To generate an average figure for what could be recycled in England the research took into account evidence which shows that deprivation has a significant impact on participation in recycling and composting (poorer households have a lower participation rate and when they do participate they put out a smaller proportion of their recyclable waste).

Recyclables Collected for Recycling and In Refuse for Disposal



Recycling rates

The research suggests that expanding current good practice recycling in England across the whole of the country could:

- Produce an England average recycling rate of 27-36 per cent.
- Poorest areas would achieve a recycling rate of 20-24 per cent of waste,
- Rich areas achieving a recycling rate of 33-47 per cent.

(The higher figures in these ranges include the provision of free collection of garden waste).

If good practice from Europe was introduced into the UK the researchers suggest that a rate of more than 60 per cent could be achieved. This is achieved through:

- Increased participation in recycling – through promotion of higher quality service and incentives such as charging for the quantity of residual waste left out (as happens in Blaby District Council).
- Collecting new materials (especially food waste).
- Promoting waste minimisation, for example reusable nappies.
- Increase recycling at civic amenity sites and other municipal waste streams (e.g. street waste).

The authors suggest that although a 60 per cent recycling rate could and should be achieved quickly in some local authority areas, it will take longer to reach a national average of 60 per cent because some local authorities have unwisely signed up to waste disposal contracts

which may prevent a rapid increase in recycling and composting. During this period of transition the researchers also suggest it would be wise to develop in parallel the market for the increasing amount of recyclable materials collected.

Minimising residual waste

Although the researchers did not look closely at this, they do suggest that further work can be done here through improving design of products. This is an area which the European Commission is pushing, through, for example, the Waste Electronic and Electrical Goods Directive. The Commission is also looking to reduce the hazardous components of residual waste through, for example, plans to introduce a directive on batteries and household hazardous waste. However, it is important to note that the European Commission is being rather timid in its approach and without more ambition it is difficult to foresee 100 per cent recyclable waste in the next ten years.

Pursuing waste minimisation is also key to reducing residual waste.

Tackling residuals

During the period when society moves towards zero waste there will be some residual waste to tackle. It is important to treat this waste in a way that has the lowest environmental impact. To try to model this, the researchers modelled impacts from different treatment methods using data on the chemical and physical characteristics of residual waste once a recycling rate of 60 per cent had been achieved. This approach was taken because waste treatment plants will have differing impacts depending on the waste that enters them. Because this approach is taken, the researchers make it clear that the results can not be applied to waste streams which have not had high levels of recyclable and compostable materials removed from them at source.

The composition of the residual waste for this study was as follows:

> garden waste 5.33%, kitchen waste 13.53%, paper 6.22%, card 3.02%, dense plastic 7.76%, ferrous metals 5.12%, aluminium 0.26%, glass 1.79, textiles 3.84%, fines 6.35%, misc combustibles 21.02%, misc non-combustables 18.34%.

What is clear is that much of this residual waste is recyclable but is not removed earlier from the waste stream due to, amongst other reasons, lower than perfect participation rates.

The research work adopted a life cycle analysis approach. This approach is increasingly being used by local authorities to help make decisions on waste management. Life cycle analysis does have significant weaknesses, for example:

- Good emissions data is not always available.
- Little is often known about the impacts of particular chemicals or mixtures of chemicals.
- The content of waste is dynamic – waste composition was very different ten years ago and will be very different in ten years time.

- The performance of treatment options changes over time (usually improving due to regulatory action).

It is vitally important to bear these weaknesses in mind, the approach can provide some useful indications but it does not provide answers. However, given that decision-makers often have to make decisions with incomplete knowledge the following information will be of use.

Climate change

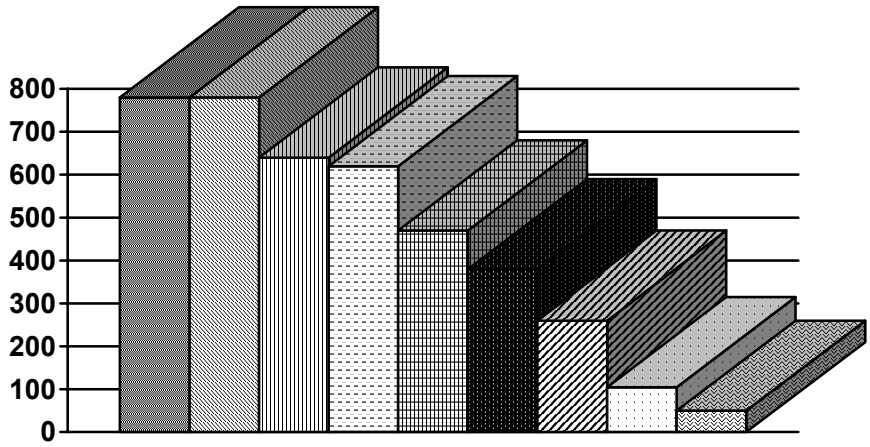
Waste disposal contributes towards climate change, for example through the release or methane from landfill sites or the burning of fossil fuel based plastics. The research suggested that untreated waste going to landfill and incineration were the worst options for climate change. Mechanical biological treatment (MBT) and Biological Mechanical Treatment (BMT) followed by the residuals from this process going to coal fired power stations or cement kilns fared best according to the model (but see commentary below). MBT with residuals going to landfill also performed well. Broadly speaking, MBT treatments separate out some of the recyclables from the residual waste mechanically and then compost (or anaerobically digest) the remaining waste producing a residual waste.

The importance of which energy is being replaced

For the analysis it was important to correctly identify which energy was being replaced by the energy produced by the disposal option. The Environment Agency model WISARD assumes that coal is being replaced by energy produced from the waste disposal options. The researchers suggested that the current energy framework leads this to be incorrect. They suggest that given increasing consumption of energy (hence energy from waste plants replacing new energy sources) and the present price structure in the energy market (where coal is cheap), gas will be the energy replaced. Pyrolysis is likely to replace renewable energy such as wind and solar because pyrolysis is included in the Renewables Obligation, which requires energy companies to buy and sell 10 per cent renewable energy. However, it is important to note that this may change if, for example, the Government were to introduce a cap on greenhouse gas emissions on the generating sector or take pyrolysis out of the Renewables Obligation. So, for example:

- should coal be the displaced fuel, the MBT option with residuals going to landfill ranks worse than pyrolysis or BMT with residuals going to fluidised bed incineration. Cement kilns and coal fired power plants still rank as the best performers.
- if one to assume that no emissions were being avoided MBT with residuals with landfill would easily rank as the preferred option.

For the study, it was assumed that for coal-fired power stations and cement kilns the fuel being replaced is coal, although it is debatable whether these plants should not be burning cleaner fuels such as gas. The results are outlined below.



Climate impact over 100 years (kg CO2 equivalents) per tonne of waste [2]

- UK standard incinerator (energy avoided gas)
- Best practice incinerator (energy avoided gas)
- MBT (thermal filter) residuals to incinerator (energy avoided gas)
- Pyrolysis (energy avoided is renewable)
- BMT to fluidised bed incinerator (energy avoided is gas)
- Landfill with methane capture (energy avoided gas)
- MBT (biofilter) residuals to landfill (energy avoided gas)
- BMT residuals to coal power station (energy avoided is coal)
- BMT residuals to cement kiln (energy avoided is coal)

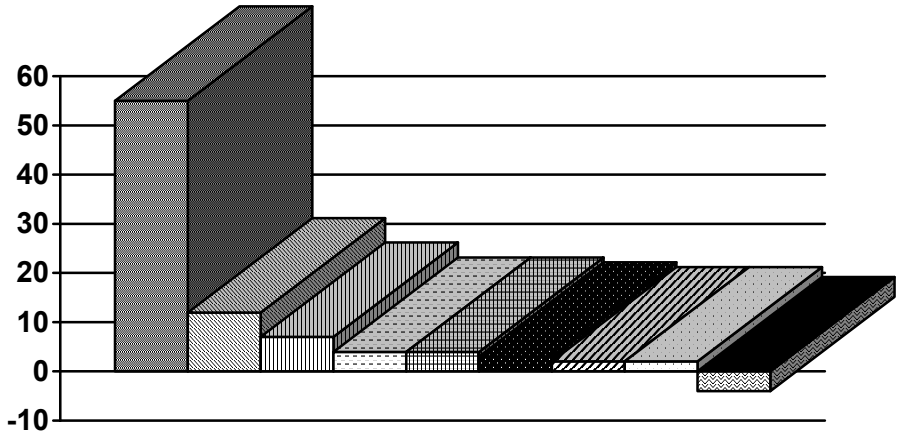
Human toxicity

Human toxicity is a measure of the potential risk to health from a plant, although as outlined below, the results from any analysis should be treated with extreme caution. In terms of human toxicity, the research suggested that untreated waste going to landfill was by far the worst option, followed by standard UK incineration. The option which fared best was MBT with the residuals from the process going to a cement kiln. Options such as pyrolysis, fluidised bed incinerator and MBT followed by residuals going to either landfill or coal fired power plants were found to perform almost as well as this option. However, the researchers make it clear that with regards to human toxicity it is extremely important to strike a note of caution on this theoretical outcome for the following reasons:

- They state they were unable to include an evaluation of the possible impacts of ash from the various thermal treatments. These impacts could be significant, especially over a long time period (100 – 1000 years) as they leach from landfills. Friends of the Earth considers that were ash included it is likely that the thermal treatments would be amongst the worst performers for this category. The researchers did provide data on the increased concentrations of contaminants in cement and although these are still below limits in some countries it is unclear whether these limits were based on a precautionary basis. They were unable to assess any health impact related to this.

- Even though the best available data was used, the data on emissions was still far from complete.
- The approach does not identify local impacts, any health impact assessment would need to consider nearby vulnerable populations (e.g. schools or hospitals).
- Releases from waste plants vary hugely depending on the quality of the operator (some cement plants scored badly in a recent assessment on operator performance by the Environment Agency).
- Some plants, such as cement kilns or coal-fired stations should be operating to higher standards for releases to air. Cement kilns should be using cleaner fuels (such as gas). Coal fired power stations should be rapidly phased out.
- Although the researchers used a recognised approach to identify human toxicity – which is based on the human limit values of chemicals identified by the World Health Organisation and others and converted to equivalents of 1,4 dichlorbenzene (is the same way that for comparisons climate change gases and converted to equivalents of carbon dioxide)- little is known about the true impact of most chemicals and the impacts of mixtures of chemicals is very poorly understood [3].

The results were as follows



Human toxicity per tonne of waste [3]

- Landfill with methane capture (energy avoided gas)
- UK standard incinerator (energy avoided gas)
- MBT (thermal filter) residuals to incinerator (energy avoided gas)
- MBT (biofilter) residuals to landfill (energy avoided gas)
- BMT residuals to coal power station (energy avoided is coal)
- Pyrolysis (energy avoided is renewable)
- BMT to fluidised bed incinerator (energy avoided is gas)
- Best practice incinerator (energy avoided gas)
- BMT residuals to cement kiln (energy avoided is coal)

Other impacts

The research also presents data on ozone depletion, acidification and smog.

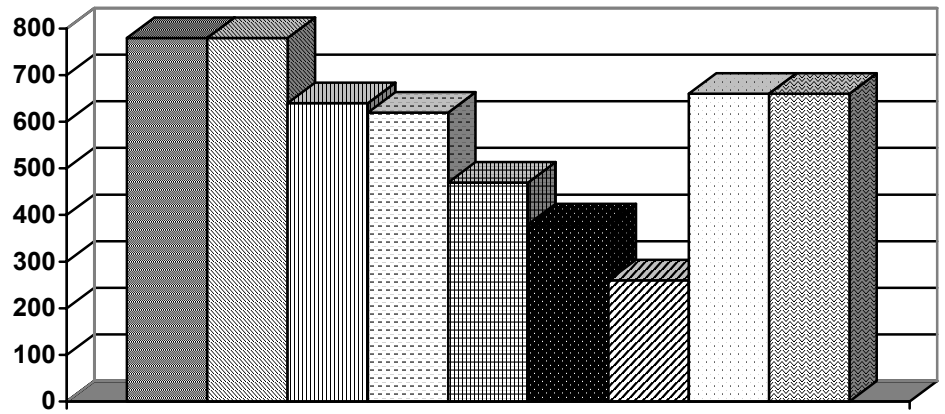
Discussion on residuals

It is clear from the analysis on climate that the avoided energy is an important factor. However, the avoided energy changes over time depending on factors such as the regulatory and economic framework. The full report outlines different scenarios depending on the avoided energy. The general shift is away from coal and towards cleaner fuels.

The analysis on human toxicity is less clear and given all the uncertainties (outlined above) it would be wrong to make any general conclusion from these findings. It is fair to say that the thermal treatments would perform much worse were it possible to model the impacts of the ash (since thermal treatments increase the toxicity of the residual waste).

From the study it appears that for two key criteria – climate and human toxicity – BMT to cement kilns and coal fired power plants scores better than other options. However, were these processes to be forced to stop burning a dirty fuel (coal) and forced to use cleaner fuels, for example gas, the story would be different, see below:

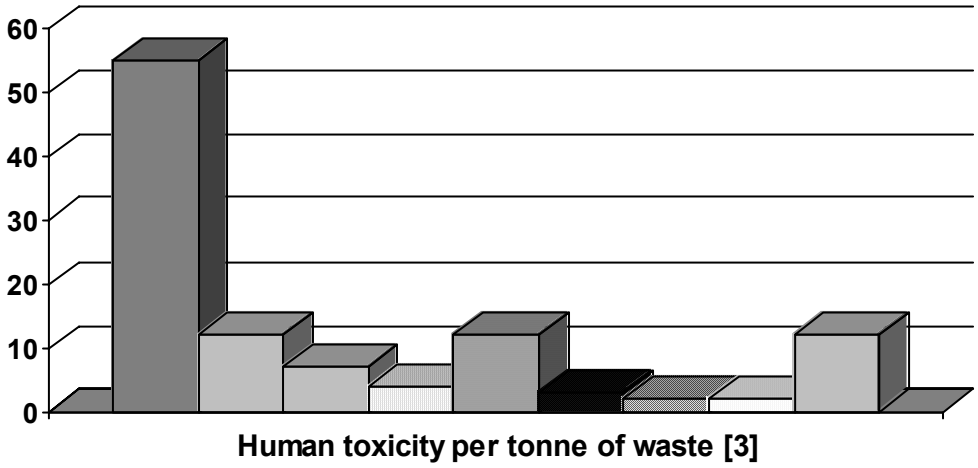
Climate change impacts where cement kilns and power plants use gas rather than coal



Climate impact over 100 years (kg CO2 equivalents) per tonne of waste [2]

- UK standard incinerator (energy avoided gas)
- Best practice incinerator (energy avoided gas)
- MBT (thermal filter) residuals to incinerator (energy avoided gas)
- Pyrolysis (energy avoided is renewable)
- BMT to fluidised bed incinerator (energy avoided is gas)
- Landfill with methane capture(energy avoided gas)
- MBT (biofilter) residuals to landfill (energy avoided gas)
- BMT residuals to power station (energy avoided is gas)
- BMT residuals to cement kiln (energy avoided is gas)

Human toxicity where cement kilns and power plants use gas rather than coal



Human toxicity per tonne of waste [3]

- Landfill with methane capture (energy avoided gas)
- UK standard incinerator (energy avoided gas)
- MBT (thermal filter) residuals to incinerator (energy avoided gas)
- MBT (biofilter) residuals to landfill (energy avoided gas)
- BMT residuals to power station (energy avoided is gas)
- Pyrolysis (energy avoided is renewable)
- BMT to fluidised bed incinerator (energy avoided is gas)
- Best practice incinerator (energy avoided gas)
- BMT residuals to cement kiln (energy avoided is gas)

The ranking in the analysis of cement kilns and power plants would also be significantly worse should the plants be forced to operate to higher pollution standards (i.e. the avoided impact would be less). These plants are amongst the most polluting in the UK for some emissions (for example, dioxins).

With regards to pyrolysis, it also performs worse than the MBT residue to landfill option from a climate perspective - regardless of whether the pyrolysis replaces renewables or gas. This is partly due to much of the energy from residuals coming from fossil fuel based plastics.

Landfill of untreated residual waste and UK standard incinerators both perform badly for both climate change and human toxicity.

The better approach, taking into account all the inherent weaknesses with any life cycle analysis such as this, is that of sending residual waste to MBT with the residuals from this process going to landfill. In Friends of the Earth's view, cement kilns and coal fired power stations should improve their pollution abatement and switch to gas.

Conclusions

This briefing is based on a fuller report which readers are urged to read. Friends of the Earth's view is that the report is useful, but like all such reports, does not provide answers but instead provides information to help make decisions.

The recycling section of the report suggests that the UK could recycle 60 per cent of municipal waste within ten years. If MBT were used for residuals this proportion would increase to more than 70 per cent. It may be possible to do more than this within ten years but 70 per cent recycling by 2012 seems a reasonable target. In meeting this target Friends of the Earth would urge the use of anaerobic digestion for source-separated biodegradable waste in most areas, so that as well as producing a compost some cleaner energy can be produced to accelerate the move away from nuclear, coal and other fossil fuels. In rural areas it may be more appropriate to compost this material.

It is difficult to predict the composition of waste in ten years time. It should be more recyclable as long as decision makers at a European, national and local level work to increase the recyclability of products. It is right to aim for zero waste and we applaud those local authorities that have set themselves targets to do so by 2020, we therefore hope that national and European decision-makers work to make sure these aspirations can be met.

In the meantime we do need to deal with some residual waste. Friends of the Earth cannot accept that these wastes should go to power stations or cement kilns. These stations are using dirty fuels with poor pollution abatement technology. They should be forced to clean-up as a matter of urgency. Friends of the Earth suggests that the best environmental route for residuals is MBT with the residuals of this process going to landfill. Zero waste and therefore zero residuals is of course the goal.

Notes

[1] For example see case studies in: Clashes with Corporate Giants, Friends of the Earth International, August 2002

[2] When viewed over periods of time climate impacts from landfills change due to the short term potency of methane (i.e. if viewed over a 20 year time span residual waste to landfill without pre-treatment performs worse). Other processes impacts barely change over periods because of releasing CO2 rather than methane, with CO2 being long-lived.

[3] For further information on the approach taken on human toxicity see: Huijbregts; priority assessment of toxic substances in the frame of CA – development and application of the multi-media fate, exposure and effect model USES-LCA, May 1999, Interfaculty Department of Environmental Science, University of Amsterdam. The data presented in this summary briefing is of human toxicity over a 20 year period.