March 2005

Friends of the Earth

Briefing

Biowaste

A guide for local campaigners

Proposals for dealing with biodegradable waste (or biowaste) are coming under the spotlight, as the EU Landfill Directive forces local authorities to divert increasing amounts of biodegradable waste away from landfill. The options for dealing with biowaste include composting, anaerobic digestion and small-scale combustion to generate electricity and heat. The environmental impacts associated with these options are often difficult to quantify. There is also a wide range of types and mixes of biowaste. How this waste can best be used as a resource depends on many factors. Friends of the Earth believes that more research is needed into the impacts associated with biodegradable waste, especially the effects on climate change and the benefits to soil.

This briefing for local campaigners explains the policy context for local decisions about biowaste proposals. It sets out the main issues and explores what is known about the best environmental options. It should be read alongside Friends of the Earth's policy position on municipal biodegradable waste.[1]

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1. Introduction

Definitions

Biomass refers to any organic material. In energy terms, biomass is considered to be a renewable fuel source.[2] Common sources of biomass fuel include crops such as willow or miscanthus which are grown to be used as fuel. If the fuel source is replaced (e.g. replanted) then it is carbon neutral: the carbon released when the fuel is heated or combusted is stored in the crops that are planted to replace it. Biomass can processed for use as a direct substitute for coal, gas and transport fuels. It can be stored and is flexible because it can provide power on command.

There are many potential sources of biomass fuels and many technologies can be used to extract energy from them. Friends of the Earth supports the early introduction of accreditation schemes for bio-fuels which certify source and sustainable management including whether the crop is carbon neutral, uncontaminated and so on. We are working as a member of the Bio-fuels Alliance to advance this idea. Factors to be taken into account in terms of supporting energy crops include the environmental impacts of how the fuel is grown or collected, how it is transported and the standard of product. Friends of the Earth opposes the use of genetically modified crops for all purposes including energy crops.

This briefing is about biodegradable waste, or **biowaste**, which is a form of biomass. Biowaste is waste material capable of decomposing under anaerobic or aerobic conditions. Commercial sources of biowaste include forestry and agricultural residues, animal waste and manure, sewage sludge and commercial food waste.

Biodegradable municipal waste (BMW) is biodegradable waste that is collected by local authorities from households, some businesses, parks and so on. Household sources of biowaste include kitchen scraps and garden waste, paper and cardboard as well as natural textiles.[3]

Policy context

The management of biowaste touches on a number of policy fields: not only the sustainable management of resources but climate change, energy, biodiversity, habitat protection, agriculture and soil protection. This section summarises some of the main issues involved.

Sustainable resource and waste management

Friends of the Earth believes that there is an environmental imperative to reduce the amount of resources we consume and to minimise the production of waste. A large proportion of the waste we generate is biodegradable. For example, recent research suggests that up to 68 per cent of household waste is biodegradable.[4]

When biodegradable waste breaks down in the absence of oxygen it releases methane, a powerful greenhouse gas. Most of the UK's waste is currently buried in the ground in landfill sites, which pollutes the soil and water as well as producing methane. The EU Landfill Directive in 1999 set targets for diverting the biodegradable fraction of municipal waste from landfill sites, which means that by 2010 the UK has to reduce the amount of biodegradable municipal waste landfilled to 75 per cent of that produced in 1995. A draft EU Biowaste

Directive also proposed the separate collection of biodegradable waste by 2010.[5]

Climate and energy use

It is now accepted that we need to get to a low carbon economy quickly to avoid dangerous climate change. Scientists on the Intergovernmental Panel on Climate Change (IPCC) estimate that global emissions must start to decline in the next 20 years. They are currently increasing at a rate of roughly 2 per cent a year. To enable emissions to decline, we need to reduce demand and find alternatives for fossil fuels. We do not want this to mean a new nuclear future. Friends of the Earth's research has shown that to reach a low carbon economy without nuclear power we must tap into the significant potential for biomass.[6]

The Government has recognised the need to develop the use of biomass for energy and has introduced a Renewables Obligation on suppliers of electricity and fuel duty cuts for transport biofuels. The EU has also published a Directive on Biofuels requiring all member states to ensure that 2 per cent of all petrol and diesel for transport placed on their markets by 2006 are bio-fuels and other renewable fuels. This target rises to 5.75 per cent in 2011.

Biodiversity and habitat protection

A third of the world's biodiversity has been lost since 1970.[7] Biodiversity and natural habitats are under constant threat from human activities including the extraction of the raw materials we use in day-to-day life, such as aluminium for drinks cans and timber for paper. Forests, in particular, play an important part in regulating the climate, stabilizing soil and preventing soil erosion, storing and purifying water. The logging of natural old-growth forests is also threatening the livelihoods of indigenous communities which live in them or survive by using forest products. It's not just the rainforests that are under threat. For example, just 5 per cent of Finland and Sweden's ancient forests (snowforests) remain. The rest have been converted into plantations.

Soil protection

Soil quality continues to be poor in some areas of Europe and the UK, and composting could significantly improve this situation. Composting clean biowaste results in a humus-rich product that can be used as a soil conditioner, to improve soil structure and to enhance its biological activity, and as a growing medium for the horticultural industry. Compost returns organic matter to the soil. It reduces harmful emissions of the greenhouse gas methane from landfills. It can also replace artificial fertilisers and peat, a scarce natural resource.

2. The best environmental route for biowaste

Reviewing the research

Deciding on the best environmental route for biowaste depends on knowing how much biowaste is produced, where it is produced, and what the impacts are of managing this waste using different techniques. Friends of the Earth commissioned a review of the existing literature on biowaste in 2004.[8] The results of that review indicated that:

- Figures for generation of waste in general and biodegradable waste in particular, are not well recorded. It is therefore only possible to collate very approximate figures.
- Studies of the environmental impacts of different options for managing biodegradable

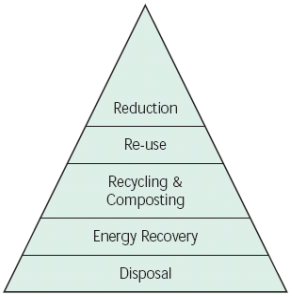
wastes generally give strong support to separate collection and recycling as preferable to landfill or incineration on environmental grounds.

- Comparisons involving composting are not adequate because the benefits of compost are not well enough understood to be quantified. The biggest area of uncertainty is in quantifying the value of humus in soil which is promoted by compost, and by other materials such as peat.

Developing a hierarchy for biowaste

Currently the 'waste hierarchy' is used to describe the best environmental route for waste in general. The waste hierarchy was first defined at European level in the 1975 Waste Framework Directive. The Government's planning policy on waste stipulates that the waste hierarchy must be applied in local waste management decisions (Figure 1). According to the waste hierarchy it is better to recycle or compost waste than use it to generate energy.

Figure 1. The Waste hierarchy [9]



Friends of the Earth considers that a hierarchy for biowaste is needed that takes account of a range of environmental factors including resource efficiency, climate change, biodiversity, habitat and soil protection as well as waste management impacts. The European Commission has proposed a hierarchy (Figure 2) for dealing specifically with biodegradable waste. It is being developed as part of an EU Thematic Strategy on Soil and therefore uses waste management and soil protection as its starting point.

Figure 2. European Commission hierarchy for biowaste [10]

- The prevention or reduction of biowaste production (e.g. sewage sludge) and its contamination by pollutants;
- The reuse of biowaste (e.g. cardboard);
- The recycling of separately collected biowaste into the original material (e.g. paper and cardboard) whenever environmentally justified;
- The composting or anaerobic digestion of separately collected biowaste, that is not recycled into the original material, with the utilisation of compost or digestate for agricultural benefit or ecological improvement;
- The mechanical/biological treatment of biowaste;
- The use of biowaste as a source for generating energy.

The need for further research

The Commission's hierarchy should give sufficient weight to the importance of developing renewable energy sources, averting climate change and reducing resource use. A recent study for the European Commission looked at the climate change impacts of different options for managing municipal solid waste (MSW). It found that source segregation of MSW followed by recycling of the paper, metals, textiles and plastics and composting or anaerobic digestion of the putrescible wastes gives the lowest greenhouse gases emissions, compared with other options for treating bulk MSW.[11] However, the study did not specifically compare different options for biowaste, nor did it look beyond municipal waste to commercial or agricultural waste. It did not assess resource use or soil quality impacts.

Friends of the Earth believes that further research should be carried out to assess the full range of impacts associated with different uses for biowaste. Local communities must be able to make informed decisions about the best environmental route for dealing with biowaste.

3. The way forward on biodegradable municipal waste

Friends of the Earth's policy position

Friends of the Earth has developed a policy position on biodegradable municipal waste (BMW) – that is, biodegradable waste collected by local authorities from households, some businesses, parks and so on. This position, which is based on the existing research literature, is set out in a separate document which can be found on Friends of the Earth's website.[1] The best environmental solution for BMW may differ from the best environmental route for commercial (e.g. catering) or agricultural biowaste.

Issues for local campaigns

The rest of this briefing sets out some of the issues about proposals for dealing with municipal biowaste that should be raised at local or regional level when waste plans are being discussed or decisions are being made about planning applications – particularly planning applications for facilities to burn biodegradable waste for energy. It is divided into four sections: technologies, waste streams land-use planning and other considerations. Relevant existing Friends of the Earth policy positions are underlined.

A) Technologies

A waste management technology is neither inherently bad nor good. Whether it is appropriate for making the best use of biowaste will depend on several factors including the composition of the biowaste, how clean or contaminated it is, how useful the final product is, what the emissions are and how far the biowaste and the final product have to be transported.[12]

Composting – Composting is biological decomposition in aerobic and thermophilic conditions (at or above 70 degrees centigrade). Composting can take place in open-air windrows (piles), covered windrows or in-vessel in specially designed containers which control moisture, temperature and aeration. Depending on the quality of compost produced, it can be used as a growing medium or as landfill cover. Composting does not produce

energy, although it can save energy by avoiding the need to produce artificial soil conditioners and fertilisers. Composting sequesters (locks) some carbon into the soil, helping avert climate change, although badly managed compost heaps can produce methane which contributes to climate change. Composting also generates bio-aerosols (airborne micro-organisms), which can have an impact on health but most studies show that within 250m from a compost plant bio-aerosols are not found above normal background levels.[13]

Anaerobic digestion (AD) – Anaerobic digestion is similar to composting but takes place in the absence of oxygen. The process produces a soil conditioner and turns most of the carbon dioxide emissions into methane which it then burns to generate energy. A recent study for the European Commission found there were environmental benefits from switching from either landfill or incineration to both composting and anaerobic digestion. Switching to anaerobic digestion would bring more environmental benefits than switching to composting, though the authors of the report considered that the benefits of composting are probably underestimated.[14] Some local authorities are proposing to use AD for treating mixed waste, but a far better quality product will be produced from uncontaminated and source-separated biowaste. Friends of the Earth supports the use of anaerobic digestion as an option for dealing with source-separated biodegradable waste. For further information see the 2003 briefing 'The Way Forward on Waste'.[15]

Combustion – Biomass can be burnt directly, to supply heat or to raise steam in order to generate electricity. Modern systems for burning biomass range from simple stoves to multi-megawatt combined heat and power (CHP) stations. Direct combustion is best suited to biofuels with low moisture content such as wood and straw. Biomass fuels can also be processed into briquettes and pellets and combusted (often in automated systems) for home, business or community-level heating requirements.

Mass-burn incineration is the combustion of mixed waste at high temperatures. Friends of the Earth does not support mass-burn incineration for any waste. For further information see the 2003 briefing 'Up In Smoke'.[16] Municipal waste incinerators burn mixed household waste, and high levels of source separation (for recycling and composting) do not generally occur in local authorities with an incinerator. In fact, incinerator operators receive more financial benefits the more biowaste they burn. This is because incinerators are subsidised under the Climate Change Levy for generating energy from the biodegradable fraction of the waste burned. So there is a clear incentive not to take waste which has first been source-separated to remove the biodegradable fraction. However, incineration is not currently eligible for Renewables Obligation certificates even for the non-fossil fuel fraction of waste burned. In general, the large size of incinerators makes this technology extremely inflexible and unable to deal with the changing composition of waste or increases in source separation. Although incinerators generate some energy, it is rarely the best way of getting value from waste. For most materials, recycling saves more energy than incineration produces.[17]

Pyrolysis and gasification – These are thermal technologies like incineration: they use high temperatures to break down carbon-based wastes. The pyrolysis process degrades waste to produce char (or ash), pyrolysis oil and synthetic gas (called syngas). The gasification process then breaks down the hydrocarbons left into a syngas using a controlled amount of oxygen. The technology can in theory treat source-separated biowaste, wood waste etc, in dedicated biomass plants. However, many proposals emerging in the UK aim

to treat mixed household waste. Friends of the Earth's views can be found in the 2002 briefing 'Pyrolysis and gasification'.[18]

Co-firing in power stations and cement kiln – The Environment Agency has recently overhauled the Substitute Fuels Protocol which governs the way that waste is used as a fuel in cement and lime kilns. It has opened the door for these kilns to burn a wider range of wastes. Meat and bone meal and sewage pellets have been identified as strong future markets for the cement industry. RDF residues from MBT processes could also be burned. Friends of the Earth opposes burning biowaste or RDF in cement kilns and power stations. These plants have poor pollution abatement technologies. Biowaste that is burned should be burned in dedicated facilities wherever possible, as these are more efficient. Burning waste in large power plants also risks breaking the proximity principle which states that waste should be dealt with as close as possible to the place where it was produced.

B) Waste streams

A wide range of biowastes can be used as valuable resources – either as secondary materials (through recycling or composting) or as fuels to generate electricity and/or heat.

Household biowaste – The key issue concerning the use of biodegradable household waste as a resource is whether the waste is collected separately at source, for instance through a doorstep collection of kitchen waste and/or garden waste. Friends of the Earth's view is that household biowaste MUST be source-separated to ensure that the input and the output are clean. This applies whether the waste is destined for composting, recycling, anaerobic digestion or another technology.

Paper and card – Friends of the Earth believes that recycling paper and card will always be the preferred option for protecting biodiversity loss. Studies suggest that it is also the preferred option for saving energy. The energy benefits increase when a paper recycling plant uses a renewable energy source.[19]

Refuse Derived Fuel (RDF) – RDF is shredded material often in pellet form, made from treated waste, usually a product of the mechanical and biological treatment of waste (MBT). It can be burned in incinerators or cement kilns. The source of the RDF is usually a mix of biodegradable and fossil fuel-based waste. Much of this can be recycled or composted. Some level of source-separation may have occurred to remove the recyclable and compostable waste first, but RDF generally contains fossil-fuel based waste such as plastic as well as paper because both have a high calorific value and burn well. Burning RDF will therefore contribute to climate change. Local authorities are increasingly looking at MBT waste treatment options which produce RDF without seeking to maximise their recycling and composting rates first. Friends of the Earth opposes the production of refuse derived fuel from mixed municipal waste. For more information see Friends of the Earth's briefing on MBT.[20]

Sewage sludge (biosolids) – Sewage sludge is a by-product from sewage plants treating domestic or urban waste waters, septic tanks and so on. In Europe around 45% is currently recycled to agricultural land, 18% is landfilled and 17% is incinerated.[21] There are different forms of sludge, from low dry matter slurries to semi-solid cake and granules. Treated sewage can be spread on land, where it can supply nitrogen, phosphorous and some potassium and sulphur. It can potentially be dried and combusted, anaerobically digested or co-composted with biomass crops, straw, wood-chips or the organic fraction of MSW.

However, sewage sludge may also contain toxic elements such as heavy metals and pathogens like E.coli and Salmonella.

Hazardous biowaste – This briefing does not deal with biowastes classified as hazardous, including CCA-treated (copper chromium arsenic) and other treated timber. Hazardous biowastes must be dealt with separately from non-hazardous biowastes, and every effort should be made to eliminate the use of hazardous materials.

C) Land use planning

The following considerations need to be taken into account by waste planning authorities when making decisions on specific applications for biowaste facilities, or when drawing up waste plans at regional or local level.

Waste hierarchy – Local authorities must drive waste management up the waste hierarchy towards waste reduction, re-use, recycling and composting. An intensive waste reduction and re-use scheme should be put in place before further options for dealing with biowaste can be properly considered.

Scale – The proximity principle, which is written into planning law,[9] means that waste should be dealt with as near as possible to the place where it was produced. Biowaste facilities of any kind, including composting, should only be provided in proportion to the amounts of waste produced in the area. Smaller, local facilities reduce the need for transporting waste long distances, and can be built to suit local circumstances. However, economies of scale can make dedicated biowaste facilities cheaper and more competitive with other technologies such as mass-burn incineration. Facilities should therefore be built at the appropriate scale for the local community. This will depend on geography, population, economics and the local market for biowaste products.

Compliance with emissions standards – A company building a waste management plant usually has to provide emissions data and complete an Environment Impact Assessment (EIA) and Health Impact Assessment (HIA) as part of its application for planning approval. This should include transport impacts. The Environment Agency is responsible for granting an IPCC licence to the operator. The Agency will need to be convinced that predicted emissions will meet national standards. However, there is currently a problem with cement and lime kilns, where the standards for some emissions are below the standards applied to incinerators for those emissions. Friends of the Earth believes that cement kilns proposing to burn waste should meet standards laid out in the Waste Incineration Directive, or equivalent standards set by the Government.[22]

Location – The precise location and design of a development and any mitigating factors that may be included (such as tree screening and road, rail or boat links) will be important for determining the impacts of transport, noise and localised pollution such as dust on local residents.

Alternatives – Local authorities now have to abide by the Strategic Environmental Assessment (SEA) Directive when drawing up waste plans.[23] Their duties include an obligation to assess alternative options. The options considered should be ‘reasonable’ and the public should be consulted.

D) Other considerations

Displaced fuel – When considering the environmental impact of a plant or scheme that generates energy, the net environmental gain as a result of displacing the use of fossil fuels must be taken into account. At present, the most likely displaced fuel is gas because coal is currently cheaper than gas. However, a cap on emissions of CO_2 from electricity generators will be introduced in 2005, and sulphur controls will tighten in 2008 ensuring that in the second half of this decade coal is more likely to be the displaced fuel. For a fuller discussion of displaced fuel, see the Community Recycling Network report 'Maximising Recycling rates, Tackling Residuals'.[24]

Efficiency – Many existing energy from waste plants (including incinerators) are not very efficient at capturing energy from waste, which means they release a large amount of carbon dioxide to produce a small amount of energy. Most power stations are more efficient.[25] Any facility which proposes to generate energy from biowaste should be Best Available Technology (BAT) and where possible use combined heat and power (CHP) technology that captures the energy produced for heating as well as electricity.

Future developments – Friends of the Earth believes that each component of the biowaste stream should be treated in a way that produces the maximum value or the highest grade product. But this could change over time, given developments in technology and in the market for recycled or composted products. It is important to make sure that biowaste proposals do not lock local authorities in to producing low-grade products (such as poor quality compost only suitable for landfill cover) in a way that rules out higher-grade uses of the biowaste stream later on.

4. Three short case studies

Composting on the Nightingale Estate

In January 2004, a new composting collection scheme began on the Nightingale Estate in Hackney. Residents store food waste in special buckets, layered to stop putrification. It is collected door-to-door and the participation rate is an impressive 89 per cent. The scheme does not attract vermin, making composting preferable to disposing of food waste in large, communal bins where it rots, attracting rats and other pests. The actual composting takes place in-vessel.

Holsworthy Biogas Scheme

The Holsworthy Biogas Scheme is an anaerobic digestion plant in Devon. It digests mixed animal manure from around 30 farms in a 5 mile radius, together with food waste from food processors. The methane fires a combined heat and power unit and electricity is sold to the grid. The heat will eventually be delivered to a number of public buildings and homes in the nearby town.

BedZED zero energy development

BedZED, the Beddington Zero Energy Development, has set out to be an environmentally-friendly, energy-efficient mix of housing and work space in Beddington, Sutton. BedZED will only use energy from renewable sources generated on site. It uses a combined heat and

power thermal unit to produce all the development's heat and electricity from tree waste, from a local tree surgery, which it says would otherwise have been landfilled.

Endnotes

[1] Friends of the Earth (2005) 'The Way Forward on Biowaste: Friends of the Earth's policy position on biodegradable municipal waste'. http://www.foe.co.uk/resource/briefings/way_forward_on_biowaste.pdf

[2] Friends of the Earth will be producing a separate position paper on biomass during 2004.

[3] See definition in European Commission (2004) 'Draft Discussion Document for the ad hoc meeting on Biowastes and Sludges'.

[4] Parfitt, Julian (2002) 'Analysis of household waste composition and factors driving waste increases' report for Strategy Unit.

[5] European Commission (2001) 'Second Draft Working Document on the Biological Treatment of Biowaste'.

[6] Friends of the Earth (2002) 'Tackling Climate Change Without Nuclear Power'. http://www.foe.co.uk/resource/reports/climate_chnge_without_nuke.pdf

[7] WWF (2002) Living Planet Report.

[8] Nigel Lee (July 2004) Review of literature on biodegradable waste. Report to Friends of the Earth, available on request.

[9] ODPM (2004) Draft Planning Policy Statement 10: Planning for Sustainable Waste Management. Consultation draft December 2004.

[10] European Commission (2001) 'Second Draft Working Document on the Biological Treatment of Biowaste'.

[11] AEA Technology (2001) 'Waste Management Options and Climate Change'. Final report to the European Commission, DG Environment. Luxembourg: Office for Official Publications of the European Communities.

[12] For further information on waste management methods see the Friends of the Earth briefing 'Waste Management Methods': http://www.foe.co.uk/resource/briefings/waste_manage_methods.pdf

[13] Health and Safety Executive (2003) ' Occupational and environmental exposure to bioaerosols from composts and potential health effects - A critical review of published data'. RR130.

[14] ECOTEC Research and Consulting Limited (2003) 'Economic analysis of options for managing biodegradable municipal waste'. Study in association with Eunomia Research & Consulting, HDRA Consultants Ltd (UK), Zentrum für rationelle Energieanwendung und Umwelt GmbH (ZREU), Scuola Agraria del Parco di Monza and LDK Consultants.

[15] Friends of the Earth (2003) 'The Way Forward on Waste'. http://www.foe.co.uk/resource/briefings/way_forward_waste.pdf

[16] Friends of the Earth (2003) 'Up in smoke: why Friends of the Earth opposes incineration.'

[17] See Friends of the Earth (2003) 'Money to Burn: perverse subsidies for incineration': http://www.foe.co.uk/resource/briefings/money_to_burn.pdf

[18] Friends of the Earth (2002) 'Pyrolysis and Gasification'. http://www.foe.co.uk/resource/briefings/gasification_pyrolysis.pdf

[19] US Environmental Protection Agency (2002) 'Solid Waste Management and Greenhouse Gases', second edition May 2002. For more information see Friends of the Earth (2000) 'Greenhouse Gases and Waste Management Options'.

http://www.foe.co.uk/resource/briefings/greenhouse_gases.pdf

[20] Friends of the Earth (2004) 'Mechanical and Biological Treatment (MBT)'. http://www.foe.co.uk/resource/briefings/mchnical_biolo_treatmnt.pdf

[21] European Commission, DG Environment (2003) 'Draft Discussion Document for the ad hoc meeting on Biowastes and Sludges'.

[22] Detailed descriptions of what is considered best practice can be obtained from the IPCC BAT reference documents (copies are available from Friends of the Earth). See also Friends of the Earth's briefing on incineration and health issues. http://www.foe.co.uk/resource/briefings/incineration_health_issues.pdf

[23] For information on Sustainability Appraisal, the process which implements the SEA Directive, see the Office of the Deputy Prime Minister (ODPM) website: http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/sectionhomepage/odpm_planning_page.hcsp

[24] Community Recycling Network (2002) 'Maximising Recycling Rates, Tackling Residuals'. http://www.crn.org.uk/gifs/tackling%20residuals%20web%20version.pdf

[25] Friends of the Earth (2003) 'Up in Smoke: Why Friends of the Earth opposes incineration'. http://www.foe.co.uk/resource/briefings/up_in_smoke.pdf