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***The social impacts of environmental taxes:
removing regressivity***

**Charging for Domestic Waste:
Combining Environment and Equity
Considerations**

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Abstract

*Compared with most other EU member states, the UK has a relatively low rate of recycling of household waste, and sends a relatively high proportion to disposal in landfill. Under the provisions of the EU Landfill Directive, this situation will have to change radically in the next ten years, with much less waste being sent to landfill, in a context in which the quantity of household waste continues to increase at about 3% per year. A number of national policy documents have in recent years proposed how this challenge might be addressed, most recently the report from the Strategy Unit in 2002, *Waste Not, Want Not*.*

Analysis in the Strategy Unit report suggests that, however the UK disposes of its waste in the coming years, and in the absence of waste reduction measures, waste disposal costs are likely to double to £3.2 billion by 2020. The increase will be much greater if the landfill tax increases from its current rate of £14 per tonne (for active waste) to £35 per tonne in the medium term, as announced by the Chancellor in the 2003 Budget.

At present households pay for waste collection and disposal through the Council Tax. Because the Council Tax is regressive (the charge is proportionately greater for poor households), increasing Council Tax to pay for higher waste costs will also be regressive. Moreover, the increase in charges would, like the current flat-rate waste disposal charge, do nothing to incentivise householders either to reduce their waste or to cooperate with recycling schemes.

The Strategy Unit recommended that local authorities should be able to introduce variable waste charging, not least to provide an incentive for both kinds of behaviour. Experience in other countries has shown that it can be expected to result in both waste reduction and an increase in the separation of recyclables. There are four possible approaches to variable waste charging: bag or tag/sticker schemes, volume-based schemes, frequency-based schemes and weight-based schemes. A comparison of international experience suggests that weight-based schemes are most successful in achieving waste reduction. In some cases these have been able to reduce waste such that their higher cost than the other schemes is more than offset, so that they become

the cheapest scheme as well as the most effective in changing behaviour. However, this cannot be guaranteed, and there are many factors to be taken into account in considering which scheme should be introduced in different circumstances.

A potential concern about the introduction of variable waste charging in the UK is that it might have a disproportionate impact on poor households (as would an increase in Council Tax, as noted above), because the generation of household waste bears little relation to income, and more affluent households tend to recycle more, thereby reducing their residual waste which would bear the charge.

If waste charging was removed from Council Tax by reducing the Council Tax for all households by the same amount (the average per household cost of waste collection and disposal), this would be progressive (i.e. poorer households would be proportionately better off compared to richer households). If a revenue-neutral variable weight-based charge was then introduced for all households, and there was no waste reduction, 92% of single-person households, and 76% of two-person households, would be better off, while most larger households would be net losers. Clearly more households of all sizes would be losers if the charges were set at a level to raise more revenue than is paid at present through the Council Tax, in order to cover the extra costs of increased recycling.

If the recycling rate was raised to around 30%, the average cost per household would rise to about £70 per year. If there was variable waste charging then less waste would be produced and a recycling rate of around 45% could be achieved for about £70 per year (Eunomia Research and Consulting 2003). Since the present costs of household waste management are about £1.2 billion per year, that is equivalent to an increase of about £500 million to £1.7 billion per year. As the Strategy Unit recognised, at least this kind of increase in expenditure will be necessary in order to meet the requirements of the Landfill Directive. If this increase in expenditure was to be funded through Council Tax at the same proportions of local to central government revenues as at present, central government would need to fund £375 million (three quarters) of the £500 million increase.

The amount of waste that households produce varies according to size. If it is assumed, as discussed above, that average waste costs will rise to £70 per year and the charges are per kilogram of residual waste then on average one-person households will pay £43 and on average couples will pay £56. If we assume that they have on average received a deduction of £50 in their Council Tax bill, the result is a difference of less than 15p per week either way.

In order to protect larger low-income households, it would be necessary to provide extra benefits for additional members. To compensate, 50p per week could be added to Child Tax Credit for all families on benefits and low to medium incomes at a cost of approximately £165 million per annum. If the objective was to ensure that all but the 20% of low-income households with the highest waste production among households of their size and composition did not lose out, there could be increases in means-tested benefits and tax credits of a further £200 million per annum, to a total of £365 million.

It may be noted that, under this scheme, central government would be spending through the benefits system about the same as the £375 million it would need to spend in support grants to local authorities to cover the additional costs of higher recycling rates, if these were to be funded through Council Tax.

Of course, all households could reduce their waste disposal costs by reducing the amount of residual waste they generate, both by producing less waste in the first place and by separating out more waste for recycling. If these effects were pronounced (especially the former), then it is quite possible, on the basis of experience in other countries, that total waste disposal costs, and therefore total waste charges, would fall from their present level, thereby significantly reducing concerns about regressivity from the change in the charging system. Of course, it would be open to individual households to reduce their own waste charges in this way whether or not other households did so as well. Given that, unlike energy and water use for example, there is no obvious 'basic needs' level of waste generation, there would seem to be fewer arguments (assuming that convenient and effective recycling facilities have been introduced) why households could not radically reduce their waste in order to reduce their exposure to variable waste charges. It is also not clear

how, in the absence of such charges, it will be possible even to curb the growth of household waste in the UK, let alone reduce such waste from its present level. On the other hand, if household waste could be reduced, then the resulting lower waste disposal charges could offset partially or completely the extra benefits needed to protect low-income households from the initially higher variable waste charges that have helped to bring it about.

1. Introduction

This paper examines the possibilities for and implications of variable charging for household waste in the context of the UK's poor record of recycling and waste reduction or minimisation. Waste minimisation is defined by the European Environment Agency's online glossary of environmental terms (glossary.eea.eu.int) as 'measures and/or techniques that reduce the amount of wastes generated during any domestic, commercial and industrial process'. The paper deals only with the household sector. Following some more general discussion of the issues, the paper goes on to describe a household waste charging scheme that should not increase costs for poorer households.

Section 2 of the paper outlines the present situation in regard to waste policy in England, particularly in the context of European legislation, the disappointing recent history of UK government policy in the area and the proposals contained in the Strategy Unit's 2002 report *Waste Not, Want Not*.

The third section discusses various issues related to charging for waste, including variable waste charging, as well as some issues related to recycling. Section 4 looks in more detail at a number of practical implications of variable waste charging, not least of which are the costs involved. It is an unfortunate fact that bare compliance with the requirements of the Landfill Directive is likely to significantly increase the costs of disposal by 2016. However, as the Strategy Unit has shown, the direct economic costs of continuing with present unsustainable patterns of waste production and disposal would not be a great deal less. Waste reduction is generally environmentally preferable to recycling because it avoids the use of resources in the first place, rather than recycling them afterwards. It can also be cheaper in the long term, although bringing it about does involve costs. Variable waste charging is widely held to be the most viable way to bring about a waste-reducing change in consumer behaviour.

Section 5 looks in more detail at the issue of regressivity in relation to waste charging. Using new data from South Norfolk District Council, it analyses the distributional implications of a simple system of variable waste charging by weight and proposes a

scheme for England that would be designed to avoid leading to additional net costs for the poorest members of society. Section 6 concludes.

2. Background

Household waste production in the UK is currently growing, at a rate of 3% a year, exceeding the rate of growth of GDP. Until recently waste policy was afforded little attention at either a national or local level in the UK. The UK has historically relied upon landfill as its primary waste disposal option. Compared to most other industrialised countries the UK has a poor record of developing alternatives to landfilling and on recycling.

“Most other European countries have a number of alternatives to landfill in place, as well as legislation and incentives to support these alternatives. Currently, almost 80% of municipal waste in England is sent to landfill sites, compared with around 50% in France and 7% in Switzerland. England recycles just 12% of its municipal waste, while Germany recycles 52% and the Netherlands 47%.” (Strategy Unit, 2002, p.7)

Factors underpinning the UK’s poor environmental performance on waste include the ready availability of cheap landfill sites, weaker regulatory controls and the absence of incentives for recycling, low public awareness and an inability or unwillingness on the part of many local authorities to invest in more expensive recycling and waste disposal options.

However, recent developments in national policy are now beginning to feed through to the local level, and with further changes in the pipeline, these will increasingly impact upon individual households and consumers over the next two to three years.

A major driver of these changes in the area of waste management is a number of European directives, including the 1975 Waste Framework Directive, the 1991 Hazardous Waste Directive (not dealt with here), the 1994 Packaging Waste Directive (see Appendix) and the 1999 Landfill Directive. The UK has generally had a poor record of implementing waste directives. For example, a 2002 European Court ruling found that the UK had failed by 1999 to implement parts of the Waste Framework

Directive and to properly transpose the Hazardous Waste Directive and the Packaging Waste Directive. The *Waste Strategy 2000* (DETR 2000) for England and Wales was designed to address these directives and particularly the new Landfill Directive. The UK is also proceeding with preparations to implement the Waste Electrical and Electronic Equipment (WEEE) Directive and the End of Life Vehicles (ELV) Directive. The EU is currently developing further directives on integrated product policy, eco-design and biowastes.

Furthermore, waste is a significant issue with respect to the UK's climate change objectives, with landfill currently accounting for some 25% of UK methane gas emissions. It is also becoming increasingly difficult to find new landfill sites in the South East in particular.

2.1 Relevant European waste directives

The Framework Directive on waste (Directive 75/442/EEC)

Under the Waste Directive, member states are required to establish an integrated waste management strategy with clearly defined time scales and objectives based on the principles of the directive. The principles are the waste hierarchy (reduction, reuse, recycling, energy recovery, incineration without energy recovery, landfilling), best available technology, the proximity principle, national self-sufficiency in waste disposal, the polluter pays principle and a duty of care for producers of waste. The Directive also establishes provision for inspection and monitoring of waste management, and lays down reporting requirements.

The Landfill Directive (Directive 99/31/EC)

The Landfill Directive requires the UK (along with Greece, Ireland, Portugal and Spain) to reduce the tonnage of biodegradable waste going to landfill to 75% of its 1995 level by 2010, 50% by 2013 and 35% by 2020. The other member states, which sent less than 80% of waste to landfill in 1995, have to meet these targets four years earlier. The UK is not currently on track to meet the targets set in the Directive.

Although the proportion of municipal waste disposed in landfill declined from 84 per cent in 1996/97 to 78 per cent in 2000/01, the *amount* actually increased from 20.6 million tonnes to 22.1 million tonnes (DEFRA, 2001).

The Waste Electrical and Electronic Equipment (WEEE) Directive (Directive 2002/96/EC)

The WEEE directive must be implemented by the end of 2004. From July 2005 all electrical and electronic equipment put onto the market must be marked. The marking will help to differentiate between new and historic WEEE. By the end of 2006 the UK must have a rate of separate collection of at least 4kg on average per inhabitant per year of WEEE from private households by this date. According to DEFRA, the UK is already meeting this target. The targets will be reviewed at the end of 2008. It is important to note that consumers have no direct obligations under the Directive. However, the producers of electrical and electronic equipment are obliged to encourage separate disposal of WEEE.¹

2.2 UK waste policy

The 1995 White Paper Making Waste Work

The first detailed framework for waste management in the UK was the 1995 White Paper *Making Waste Work* (Department of the Environment, 1995). It set the following aspirational targets:

- To reduce the proportion of controlled waste going to landfill from 70% to 60% by 2005;
- To recover value from 40% of municipal waste by 2005;
- To recycle or compost 25% of household waste by 2000.

The proportion of municipal waste recovered (recycled, composted or incinerated with energy recovery) rose from 13.6% in 1996/97 to 21.3% in 2000/01. The proportion of household waste recycled or composted rose from 7.5% in 1996/97 to 11.2% in 2000/01.ⁱⁱ It can be seen that the third target was missed by a very large margin.

The Waste Strategy 2000 for England and Wales

This Strategy (DETR, 2000) replaced *Making Waste Work* as government policy in the area. It set new targets:

- To reduce the amount of industrial and commercial waste landfilled to 85% of 1998 levels by 2005;
- To recover value from 40% of municipal waste by 2005, 45% by 2010 and 67% by 2015;
- To recycle or compost at least 25% of household waste by 2005, at least 30% by 2010 and at least 33% by 2015;
- In accordance with the Landfill Directive, to reduce the amount of biodegradable waste going to landfill to 75% of 1995 levels by 2010, 50% by 2013 and 35% by 2020.

A number of levers were set out in the Waste Strategy. The Waste and Resources Action Programme (WRAP) was set up to overcome market barriers to promoting re-use and recycling. It focuses on developing markets and end-uses for re-used and recycled materials. The government set up a pilot scheme for public procurement of recycled goods, initially recycled paper. A voluntary agreement with newspaper publishers to increase the recycled content of newsprint was announced. A similar voluntary agreement with the direct 'junk' mail industry has been reached (Strategy Unit 2002, p.64) .

The Waste Strategy proposed a system of tradable permits for the landfill of biodegradable municipal waste to be allocated free to local authorities. The aim is to enable local authorities to meet their targets under the Landfill Directive with greater flexibility and at lower cost. This proposal was contained in the Waste and Emissions Trading Bill, which was passed by Parliament in 2003. The Secretary of State for the Environment, and the devolved governments, now have powers to allocate to waste disposal authorities in their areas the maximum amount of allowances for the landfill of biodegradable municipal waste in Directive target years (see <http://www.defra.gov.uk/environment/waste/wetbill/index.htm> for details).

The 1999 Budget Statement announced that the standard rate of landfill tax would increase from £10 per tonne by £1 per tonne per year until 2004.

The targets in the Waste Strategy for recycling or composting of household waste are to be achieved by statutory performance standards for local authorities responsible for waste disposal. The following standards were set to be achieved by 2003/4:

- Local authorities that were recycling under 5% in 1998-99 must recycle over 10%.
- Local authorities recycling between 5-15% in 1998-99 must double their rate.
- Local authorities recycling over 15% in 1998-99 must recycle a third of household waste.

If those standards are met, they would mean a national recycling and composting rate of 17%.

Further standards for 2005/6 were set in 2001:

- Local authorities with 1998/99 household waste recycling and composting rates of under 6% to achieve at least 18%

- Local authorities with 1998/99 household waste recycling and composting rates of between 6% and 12% to at least treble their recycling and composting rate
- Local authorities with 1998/99 household waste recycling and composting rates of between 12% and 18% to reach at least 36%
- The remaining authorities to recycle or compost at least 40% of household waste.

If those standards are met, they would mean a national recycling and composting rate of 25%.

The Waste Strategy was strongly criticised in a parliamentary committee report (House of Commons Environment Transport and Regional Affairs Committee, 2001). The report rehearsed a number of specific criticisms of the Waste Strategy: that it failed to adequately reflect the need to reduce waste production, that it was over-focused on achieving the targets in the Landfill Directive, that it was ambiguous on the issue of incineration and that it was dominated by municipal waste, to the exclusion of the larger streams of commercial and industrial waste and the problematic 'hazardous waste'. Their most serious criticism was that 'the document fails to provide a real vision or strategy', but instead a list of aspirations and some relatively weak levers to achieve those aims. The report also pointed to the inadequacy of data on waste, which is incomplete, unreliable and often published too late to be of use.

The 2002 Strategy Unit Report

A new waste strategy for England (*Waste not, Want not - A strategy for tackling the waste problem in England*) was proposed by the Strategy Unit at the end of 2002 (Strategy Unit, 2002). It was more ambitious than the Waste Strategy 2000, although it is important to note that it is only a proposal. However, the recent Energy White Paper was rather similar to the earlier Strategy Unit report on that subject, so it is

likely that any future White Paper will contain many of the Strategy Unit's proposals, although no White Paper is planned at present.

The Strategy Unit proposed the following targets:

- Reducing the rate of household waste growth from 3% to 2% per annum by the end of 2006;
- 50% of households carrying out home composting by 2006;
- The nationwide roll out of kerbside recycling collections;
- A target of at least 35% of household waste being composted or recycled by 2010 and at least 45% by 2015;
- An absolute reduction in the amount of municipal waste going to landfill by 2007;
- 30% of local authorities to have tried incentive-based schemes for household waste by 2005/6.

The Strategy Unit recognised the need for a comprehensive framework of economic and regulatory measures to ensure that these objectives were met. The Strategy Unit pointed out that householders currently pay the same Council Tax no matter how much waste they produce or whether they recycle or not. Some local authorities in many other industrialised countries have variable charging for household waste. They suggested Council Tax discounts or reward schemes for people who compost or recycle regularly, or variable charging where households pay according to the amount of unrecycled and unsorted waste they produce. Before the publication of the report, it was reported that the Strategy Unit would propose that households should be allowed two bags of waste collected each week, but that they would have to pay £1 for each additional bag. That potentially controversial measure did not find its way into the final report. Instead, they discussed the idea that the costs of waste management could be taken out of Council Tax and paid for separately through variable charging schemes. Significantly, the Strategy Unit report called for early legislative changes to allow local authorities to implement incentive and charging schemes for municipal waste collection.

The report's recommendations also included:

- A significant increase in the landfill tax over the medium term. It noted that a rise to £35 a tonne is required to change behaviour, signalled several years in advance to allow the development of alternatives.ⁱⁱⁱ
- An extension of voluntary agreements with industry to reduce waste and increase the use of recycled materials and the recyclability of products.
- Further consideration of incentives to increase the re-use and recycling of goods such as:
 - deposit schemes for hazardous items such as glass bottles, batteries, light bulbs, etc
 - product taxes on single use items such as batteries, plastic bags, etc
 - reduced rates of VAT for recycled goods
 - removal of barriers to the use of recycled goods, such as inappropriate British Standards
- Revision of the building regulations to require housing developments with more than 50 houses to allocate space for easily accessible recycling facilities.
- (Voluntary) green procurement and waste reduction targets for the public sector, and new Best Value indicators for local authorities.
- The development of (European) quality standards for compost.

In addition the report called for the case for a ban on the landfilling or incineration of recyclable products to be reviewed in 2006, tougher sentences for waste crimes, for the case for an incineration tax^{iv} to be kept under review, and for an independent body to be established to review the evidence on the health and environmental effects of different waste disposal options.

The report identified four key areas for investment. First, tackling the growth in waste. It proposed increasing WRAP's role in waste reduction programmes, expanding home composting and increasing funding to Envirowise to help industry reduce waste. Second, developing the infrastructure for recycling and associated

education. It proposed that kerbside recycling programmes, focusing on organic waste, should be rolled out. Third, improving data and research on waste management. Fourth, funding for pilots of alternative technologies for waste treatment.

The Strategy Unit estimated that the cost of implementing the strategy set out in its report would be only about 10% greater for local authorities than the costs of continuing present waste disposal practices and trends over the 18 years to 2020 (£29.6 billion versus £26.7 billion). Its strategy involved reducing the rate of growth in waste, 45% recycling, 10% incineration, 20% mechanical biological treatment (MBT) and other recovery technologies, and 25% landfill. The present mix is about 80% landfill, 10% incineration and 10% recycling. A ‘maximum recycling’ strategy of 60% recycling, 30% landfill and 10% incineration (but, unfairly for comparison, without reduction in waste growth) would be about 5% more expensive still (£31.0 billion), but was judged to require a huge change in culture and behaviour, be less feasible in policy terms than pursuing a range of options and would still leave a significant residue for landfill.

In December 2002 DEFRA announced the allocation of £76 million from the National Waste Minimisation and Recycling Fund to help local authorities set up recycling and waste initiatives across England. This announcement related to initiatives for 2003/04 and followed a previous allocation of £40 million from the fund to help projects during 2002/03. This earlier announcement also ring-fenced £21 million for projects in London over the two-year period (DEFRA, 2002).

Local authorities and recycling

In the Foreword to the Strategy Unit’s report, the Prime Minister writes: *‘It is excellent that some local authorities are really starting to deliver on recycling. But the majority are not, and many are not even trying seriously. We need now a step change.’* (p. 3)

Parfitt (2002) points out that the authorities that report the highest rates of recycling (up to 35%) have targeted collection of garden waste for centralised composting although much of it would probably have been composted at home or left *in situ*. The composting of garden waste is an easy way for authorities to obtain apparently high recycling rates. Weight-based recycling targets that do not differentiate by material are encouraging more waste to enter the waste stream. Among authorities that have not targeted garden waste, the maximum recycling rate is less than 20%. Parfitt also points out that the authorities with the highest recycling rates are among the least socially deprived, while the authorities with the lowest rates are among the most socially deprived. It is known that the affluent tend to be more enthusiastic about recycling, while members of socially excluded groups are more likely to belong to the 10-15% of the population who say they would not recycle in any circumstances (MORI, 2002).

However, higher recycling rates are found in many other European countries than even the best found in Britain. The more general problem of relatively low participation in kerbside recycling is due primarily to problems of information, awareness, motivation and culture. For instance, MORI research for the Strategy Unit report found that half of people who lived in areas with kerbside recycling had said that they did not have kerbside recycling and the vast majority had said that they would recycle more if they did have kerbside recycling (MORI, 2002).

Access to appropriate composting and recycling facilities are key issues for consumers. In particular it has been shown that access to kerbside recycling facilities is a major determinant of household recycling behaviour (Resource Recovery Forum, 2002).

There are some additional minor issues of access for people who live in blocks of flats and for those who live in small or crowded homes. It is difficult to carry several boxes of sorted waste for recycling down to the bottom of the block. It is also difficult to find space for several boxes in a small kitchen. Many schemes instead provide a single box for all dry recyclables and perhaps a closed box for organic waste. A single box for dry recyclables means that more sorting has to be done centrally, but it makes it easier for people to participate, particularly if they live in a flat or cramped premises.

The choices that individual consumers can make about the disposal of waste are usually highly constrained by the nature of the waste management and recycling infrastructure in the places where they live. If there is no convenient means of recycling, then people who wish to do so find their choices effectively constrained. If recycling is available, people are currently free not to participate.

Some members of socially disadvantaged groups are those most strongly objecting to recycling personally, arguing that their lives are difficult already (MORI, 2002). There is a question about whether the most socially disadvantaged groups might lack access to sufficient choices to enable them to recycle as much of their waste as more affluent groups. The evidence is that poorer households consume more canned food, while richer households consume more fresh food and food packaged in plastic (University of East Anglia et al, 2000). Given that metal cans can easily be recycled, while plastic is currently difficult and expensive to recycle, the limited data available would suggest that is not likely to be the case.

3. Charging for waste

3.1 The Strategy Unit recommendation

England spends about 60% of the EU average on waste management and disposal and around 40% of those at the leading edge of waste management. Waste management accounts for around 0.5% of GDP in the UK versus 1.0% in the Netherlands (Strategy Unit 2002). Because of England's reliance on landfill, householders pay some of the lowest rates for waste collection and disposal in Europe – around £50 per year on average (Enviros Aspinwall, 2000), which is roughly half the EU average and about 30% of the rate of high performing countries. England's lower spend on waste per capita reflects both the relative cheapness and the efficiency of landfill. However, while some landfill will justifiably continue to provide a disposal route for certain wastes (Eunomia Research and Consulting, 2001), England's current over-reliance on this form of waste disposal means that significant environmental impacts are not being captured in what households pay.

The Strategy Unit report states:

“**householders** need to reduce the waste they produce, for example through home composting and purchasing goods with less packaging; reusing products; using recycling facilities; and contributing to collections for composting facilities where home composting is not practical” (Strategy Unit 2002, p.13).

Waste reduction (producing less waste start with) is generally environmentally preferable to recycling. Unfortunately, MORI (2002) found that members of the public are not aware of that and perceive the environmental impact of a product being negated if it is recycled. The most effective way of getting consumers to reduce the amount of waste they produce is through variable waste charging for unsorted waste. Under these schemes, people are charged according to the quantity of residual (non-recycled) waste they consume. Variable charging could be considered to reduce personal choice because people have to pay more if they do not recycle. On the other hand, landfilling and incineration of waste and the consequent waste of recyclable resources have greater environmental impacts on society as a whole. It is a matter of trading off different kinds of constraints.

It was reported that the Strategy Unit was considering a proposal that each household should be allowed two bags of rubbish per week, but would have to pay £1 for each additional bag. The idea was criticised in the press as meaning that people would have to pay twice for their rubbish. The final report’s discussion of variable charging stated: “A key element of these direct or variable charging schemes is that the waste management element of Council Tax is **replaced** by a charge related to the amount of weight of **unsorted** waste in order to finance recycling services. It does **not** involve people being charged twice to have their waste collected and disposed of. On the contrary, it creates incentives to compost or recycle in order to **lower** the charge. The scheme is therefore an incentive-based one where people who compost and recycle **pay less**.” (Strategy Unit 2002, p. 60, original emphasis)

In the event the Strategy Unit report only recommended that the law in the UK should be changed so that Local Authorities should become free to introduce “incentive schemes to encourage waste reduction and recycling if they wish to do so” (Strategy

Unit 2002, p. 130), a freedom to introduce variable waste charging that exists in many other industrialised countries.

3.2 Variable waste charging systems

Variable charging for waste not only encourages people to recycle, but also makes them more conscious about avoiding producing waste in the first place. Variable charging schemes in North America have reduced the amount of residual waste disposed of by 15-45% without any apparent problems of additional unauthorised dumping (Enviros Aspinwall, 2000). Similar results have been found in Europe (Eunomia Research and Consulting, 2001).

There are essentially four different systems of variable rate charging for household waste:

1. Bag or tag/sticker schemes: the waste collector only picks up waste that has been placed in specially identified bags or containers. Householders may purchase either special bags or tags/stickers which must be fixed to the standard bags or containers used.
2. Volume-based schemes: householders choose a waste container or bin of a certain volume and an annual charge is based on container volume and often the collection frequency as well.
3. Frequency-based schemes: householders choose the frequency of their collection (usually either weekly or fortnightly) and pay accordingly. Alternatively, they pay only when they put out waste for collection.
4. Weight-based schemes: collection vehicles are fitted with automatic weight-recording devices which record the mass of the waste collected. Each household's bin is fitted with an electronic identification transponder to identify it.

Many authorities have introduced hybrid systems with a fixed fee for a basic level of service and a variable fee for more frequent collection or the collection of additional containers above the specified minimum limit. The strengths and weaknesses of the different schemes are discussed in Table 3.1, and further below.

Table 3.1: Strengths and weaknesses of different variable waste charging schemes

STRENGTHS	WEAKNESSES
<p>Bag or tag/sticker schemes</p> <p>Easy to implement and operate and provides a direct incentive for waste reduction.</p> <p>Allows residents full flexibility.</p> <p>Simple billing system.</p> <p>No special arrangements necessary for multi-occupancy buildings.</p> <p>Sealed bags/sacks prevent use by other people.</p>	<p>Bags/sacks require manual collection and not compatible with automatic collection systems.</p> <p>Refuse easily scattered from damaged bags.</p> <p>Possible loss or theft of tags/stickers.</p> <p>Unstable revenue stream.</p> <p>May encourage residents to store waste for excessive time.</p> <p>Use of bags may be seen as a retrograde step.</p>
<p>Volume-based schemes</p> <p>Relatively easy to install in areas that already use wheeled bins and automatic uplift systems.</p> <p>May be considered an intermediate step which allows residents to engage in waste reduction.</p> <p>Fairly stable revenue stream.</p>	<p>Resident problems in selecting a suitable bin size.</p> <p>System limited by range of bin sizes offered.</p> <p>Fixed annual charge removes incentive to reduce waste below chosen capacity.</p> <p>High up-front capital costs.</p> <p>Difficult in multi-occupancy dwellings.</p> <p>Complex billing process – requires tracking of bin sizes by address and checking during collection.</p> <p>Waste cramming by residents.</p>

<p>Frequency-based schemes (fixed frequency)</p> <p>Easy to implement and operate, requiring only changes to the billing system.</p> <p>Low capital cost because uses existing bins.</p> <p>May result in significant reductions in collection time (and costs).</p> <p>Fairly stable revenue stream.</p>	<p>Public health and amenity concerns from waste storing.</p> <p>Fixed annual charge removes incentive to reduce waste collection below chosen frequency.</p> <p>Staff must ensure that chosen frequency has been paid for.</p> <p>Waste cramming by residents.</p>
<p>Frequency-based scheme (at call)</p> <p>Allows residents full flexibility.</p> <p>Provides direct incentives.</p> <p>Automated billing system.</p> <p>Uses existing bins.</p>	<p>Public health and amenity concerns from waste storing.</p> <p>Cost of transponders and associated equipment to record uplifts.</p> <p>Difficulties associated with installing transponders to existing bins and matching addresses</p> <p>Relatively unstable revenue stream.</p>
<p>Weight-based schemes</p> <p>Allows residents full flexibility.</p> <p>Provides direct incentives.</p> <p>Flexible automated billing.</p> <p>Provides good data for decision making in waste management</p>	<p>Expensive to set up – requires sophisticated weighing equipment.</p> <p>Possible inaccuracies in data logging.</p> <p>May be significant increases in collection times because of care required in weighing process.</p> <p>May encounter higher levels of opposition.</p> <p>More susceptible to waste illegally placed in other people’s bins – particularly in multi-occupancy dwellings.</p>

(Adapted from table in Envirospinwall 2000, pp. 11-12)

Volume-based and fixed frequency-based schemes have the obvious problems that they are inflexible, do not provide incentives at the margin and many people are tempted to err on the side of paying for more service than they need. They are also difficult to operate in multi-occupancy buildings. However, they are popular in North America.

At-call frequency-based schemes do not have these disadvantages, but they lead to waste hoarding, which is a public health and amenity issue. People in smaller homes do not have the ability to store waste for long periods that those in larger homes have, so there is also an issue of social justice.

The most common types of schemes use tags or stickers. They are relatively cheap and administratively simple to operate. People must pay for the tags or stickers that are distributed, with additional tags or stickers available from shops at a higher rate. Theft of other people's stickers or tags can be a problem, particularly in multi-occupancy buildings. Some schemes use special bags, but that is more complicated and expensive to operate, so less common, even though it is less susceptible to theft. Bag or tag/sticker schemes are considered better in terms of incentives for waste reduction than volume or frequency schemes, but not as good as weight-based schemes.

Weight-based schemes have been introduced in a number of municipalities in Europe and were piloted in a few towns in North America in the mid-1990s. The North American schemes experienced a number of problems with the technology. They found that there were substantial opportunities for error in the system and that because disputes over the weight billed occurred significantly after the fact they were virtually impossible to determine (Enviros Aspinwall, 2000). However, schemes in European countries have been successful (Eunomia Research and Consulting, 2001). These schemes have usually been operated in municipalities with few multi-occupancy buildings. Because of the problem of people putting their rubbish in other people's bins, it is necessary for bins in multi-occupancy buildings to be lockable. Such schemes have been successfully tested or implemented in a number of municipalities in Germany (Eunomia Research and Consulting, 2001).

Because of concerns about social exclusion, some American schemes (although not European ones) provide free tags or reduced rates for welfare recipients. However, very few schemes do provide such discounts, possibly due to the additional complexity and because in most cases the annual cost of waste services is not high compared to other utility bills, typically less than £100-150 per annum (Enviros Aspinwall, 2000). Clearly a key question for the UK is how could the additional costs of a more sustainable waste management system, including variable waste charging, could be borne without disproportionately increasing the costs for the poorest households. It was to this question that the research in this project was largely directed, as described in the rest of this paper.

4. Implications of variable waste charging for the UK

4.1 Costs and benefits of variable waste charging options

Eunomia has estimated the costs and benefits of four different options for variable waste charging based on the experience in the US and Europe (Eunomia Research and Consulting, 2003). The options were a weight-based system, a sack-based system and two forms of bin identification system (one more capital-intensive, the other more labour-intensive). The bin identification systems have a chip that allows householders to be charged when they put out a bin, but do not involve weighing them.

Eunomia's estimates consider the incremental costs of implementation. In other words, they allow for the additional costs of buying new vehicles that can implement a particular system, but do not allow for the costs of replacing existing useful vehicles simply to introduce a new system of charging. The only one of the options considered that could be implemented without new equipment is a sack-based charging system. It could be implemented even in areas that currently have bins if the sacks were to be placed in the existing bins. Eunomia's estimates are based on the assumption of a source separation rate before variable charging of 32 percent, which is found in some UK local authorities with centralised composting, but is much higher than the national average. Eunomia assumes an existing cost of £66.04 per household, but in many

local authorities that do little recycling at present the cost is only about £50, although government targets mean that will have to rise quickly anyway.

When all four systems were assumed to have the same effect, they calculated based on the US experience that there would be a six per cent source reduction and a 16 percent improvement in separate collection of recyclables. Eunomia calculated that at present disposal costs for the UK, the net cost per household increases from £66.04 to £70.11 for a sack-based system or £72.72 for a weight-based system, with the bin identification systems in between at £72.24 and £71.58. Under these assumptions, the very low technical and administrative costs of the sack-based system narrowly win out. It is worth noting in this regard that in practice it would be difficult for the half of local authorities that now have bin-based systems to go back to sacks because refuse collection staff prefer to work with bins for health and safety reasons.

However, although weight-based charging is the most expensive to introduce, experience in Europe shows that it leads to greater source reduction and greater accuracy of separation than the other options. Under this assumption, a weight-based system led to a 25 percent source reduction, and a 33 percent increase in the separate collection of recyclables; the bin-based systems to a 13 percent source reduction and a 27 percent increase in the separate collection of recyclables; while the sack-based system led to a six per cent source reduction and a 16 percent improvement in separate collection of recyclables. With these assumptions, the cost of the sack-based system remained at £70.11, the bin-based systems dropped to £69.12 and £68.55, and the weight-based system fell to £61.72. That made the weight-based system £4.23 *cheaper* than the existing system.

Even if a weight-based system does not bring such a substantial source reduction as assumed in these calculations, it can be seen that it only needs to deliver slightly more source reduction than the other systems to be cheaper on balance, despite the higher capital costs to set it up. However, this cannot be guaranteed, and there are many factors to be taken into account in considering which scheme should be introduced in different circumstances.

On the other hand, these calculations are based on a typical cost of £30 per tonne for residual waste disposal. If residual waste disposal costs increase (with, for example, an increased landfill tax) then the economics of variable waste charging, and particularly of weight-based systems that bring about the greatest source reduction, look even better.

There is controversy over whether the source reduction found with variable waste charging is real, or whether the waste is instead somehow displaced. Opponents of variable waste charging frequently assert that the waste cannot just disappear, it must go somewhere – and that somewhere must be undesirable, in the form of fly-tipping or car trips to friends in other areas that do not have variable waste charging. Eunomia found that in a case study in Landkreis Schweinfurt (Germany), where the recycling rate increased from 64 percent to 76 percent and residual waste production fell by 43 percent, it could be shown that the reduction was accounted for principally by diversion of waste from the biowaste bin (which was charged for) to households' gardens.

4.2 Waste charges and Council Tax

Waste charges are currently included in Council Tax. Because this tax has a smaller range (between high and low Council Tax bands) than income (see Table 4.1), Council Tax is a regressive tax. The existing ratios for charging do not reflect the ratios in the value of the homes concerned, but are roughly the square root of those ratios, except for Band A households who pay rather more. The ratio is also less than the ratio between average incomes in the bands, which is similar to the ratio between house values.

Table 4.1 Council Tax bands and ratios

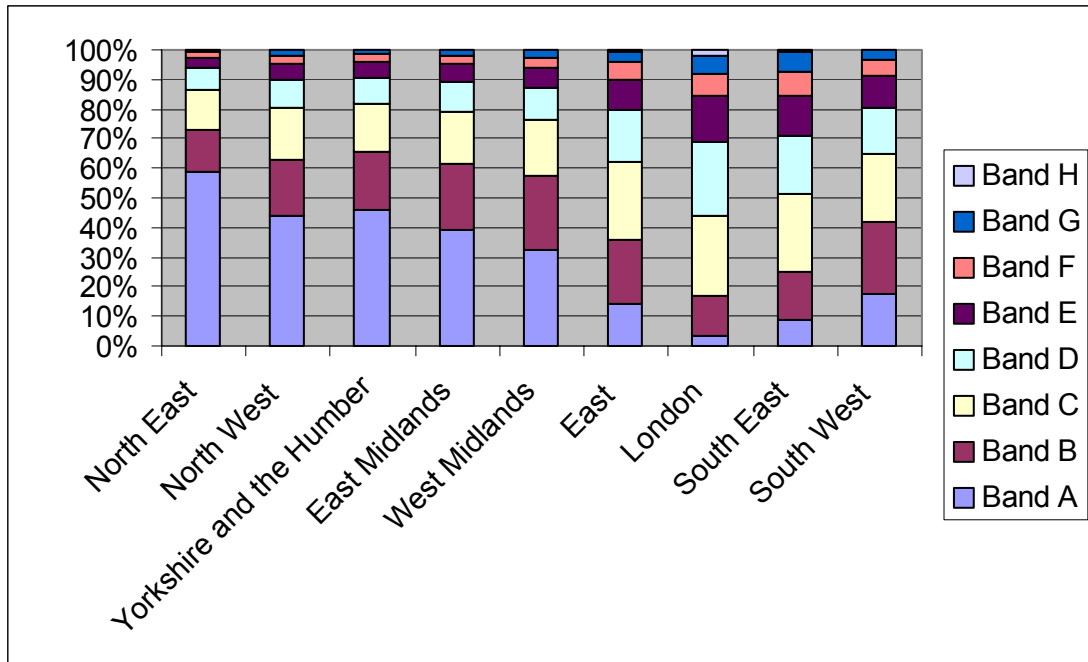
Valuation Band	Value at 1st of April 1991	Ratio to Band D
A	Up to £40,000	6/9ths
B	Over £40,000 and up to £52,000	7/9ths
C	Over £52,000 and up to £68,000	8/9ths
D	Over £68,000 and up to £88,000	1
E	Over £88,000 and up to £120,000	11/9ths
F	Over £120,000 and up to £160,000	13/9ths
G	Over £160,000 and up to £320,000	15/9ths
H	Over £320,000	18/9ths

However, because about 75 percent of local authorities' funding comes from central government block grants, rather than Council Tax, the amount of money that is actually paid out of Council Tax for waste services is only about 25 percent of the total cost (excluding any special payments made by central government to support recycling schemes). Reducing households' Council Tax bills by the entire amount would also involve reducing the central government block grant. Transferring the entire cost to direct charges would be necessary in order for the marginal cost of an additional unit of waste to be high enough to have any incentive effect for most households. What can be said is that if the waste component of Council Tax were stripped out of Council Tax by a fixed amount across households (the amount might differ across local authorities), this would be progressive in respect of the Council Tax payments (i.e. those of lower income households would tend to fall proportionately more than those of richer households), although it would be regressive in terms of waste charges if these were levied on a per-household basis.

Figure 4.1 shows that Council Tax bands are distributed very differently by region. It should be noted that in regions where Band A is predominant, such as the North East (60% of homes) and Yorkshire (46%), Council Tax band is a less good indicator of income than in regions such as London and the South East where there are few homes in the bottom bands and a large number in the higher bands. Regression analysis

shows that the overall correlation between income and Council Tax band is 0.396, so 39.6% of the variance in income is reflected in Council Tax band. The correlation is strong, but not overwhelming.

Figure 4.1 Percentages of homes in different Council Tax bands by region



The distribution of Council Tax bands according to income decile among English households in the Family Expenditure Survey 2001 is as shown in Table 4.2.

Table 4.2 Distribution of Council Tax band according to income decile

	Band A	Band B	Band C	Band D	Band E	Band F	Band G	Band H
Decile 1	34.4%	22.5%	21.1%	10.6%	6.4%	2.8%	2.3%	0%
Decile 2	34.1%	23.5%	15.5%	15.9%	6.6%	2.7%	1.8%	0%
Decile 3	28.6%	16.4%	24.8%	12.2%	10.1%	4.6%	2.1%	0.8%
Decile 4	25.9%	24.4%	23.7%	13.5%	6.0%	2.3%	3.4%	0.4%
Decile 5	29.3%	21.4%	19.9%	16.5%	5.3%	4.9%	1.5%	0.8%
Decile 6	24.5%	26.0%	19.7%	14.4%	8.5%	3.8%	3.1%	0%
Decile 7	21.4%	24.6%	17.8%	19.6%	8.3%	5.3%	2.1%	0.9%
Decile 8	20.5%	21.4%	23.3%	17.1%	6.8%	5.3%	3.7%	0.6%
Decile 9	18.4%	20.2%	17.2%	20.6%	11.7%	5.2%	5.2%	1.2%
Decile 10	11.5%	14.1%	21.1%	23.7%	15.9%	8.9%	4.2%	0.5%

The percentages recorded for the higher bands are clearly not very reliable because they are subject to random sampling error. It can be seen that quite a large proportion of wealthy households live in homes with low Council Tax bands (47% of Decile 10 live in houses in Bands A-C), while very few poor households live in homes with high Council Tax bands (only 5% of Decile 1 live in houses in Bands F-H).

Table 4.3 below shows the distribution of income deciles according to Council Tax band among English households in the Family Expenditure Survey 2001.

The figures given for the higher Council Tax bands in Table 4.3 should be taken with extreme caution as there were too few households in those bands to give statistically reliable results. However, it can be seen that the correlation between income and Council Tax band is not as high as might be expected. It can be seen that rich households are only somewhat under-represented among households in the lowest bands, while poor households are very under-represented among households in the highest bands.

Table 4.3 Distribution of income decile according to Council Tax band

	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
Band A	10.9%	11.2%	9.9%	10.0%	11.4%	11.4%	10.5%	9.6%	8.7%	6.4%
Band B	7.9%	8.6%	6.3%	10.5%	9.2%	13.4%	13.4%	11.2%	10.7%	8.7%
Band C	7.8%	5.9%	10.0%	10.7%	9.0%	10.7%	10.2%	12.7%	9.5%	13.7%
Band D	4.7%	7.3%	5.9%	7.3%	8.9%	9.3%	13.4%	11.2%	13.6%	18.5%
Band E	5.4%	5.8%	9.3%	6.2%	5.4%	10.4%	10.8%	8.5%	14.7%	23.6%
Band F	4.3%	4.3%	7.9%	4.3%	9.3%	8.6%	12.9%	12.1%	12.1%	24.3%
Band G	5.6%	4.5%	5.6%	10.1%	4.5%	11.2%	7.9%	13.5%	19.1%	18.0%
Band H	0%	0%	12.5%	6.3%	12.5%	0%	18.8%	12.5%	25.0%	12.5%

Two-thirds (66.5%) of households in England as a whole are in the bottom three bands, but the pattern varies widely between areas, as shown in Table 4.4, which gives the percentage of households in each Council Tax band in England as a whole, in the district with the lowest average Council Tax band (Easington) and the district with the highest average Council Tax band (Kensington and Chelsea).

Table 4.4 Percentages of households in each Council Tax band

	Band A	Band B	Band C	Band D	Band E	Band F	Band G	Band H
England	25.8%	19.2%	21.5%	15.0%	9.4%	5.0%	3.6%	0.6%
Easington	82.1%	6.2%	5.8%	3.5%	1.6%	0.4%	0.2%	0.05%
Kensington and Chelsea	0.7%	3.9%	10.5%	15.6%	15.5%	13.9%	23.5%	16.5%

It can be seen that even if there was a rebalancing of the ratios charged for Council Tax to cover the shift to variable waste charging, there is little possibility for a district such as Easington to protect even Band A households from increases because there are so few households in higher bands to cover the additional costs. By contrast, it would be easy for a district such as Kensington and Chelsea to do so because there are a great many households in the higher bands. Taking the regions as a whole, Band A is dominant in the North and Bands A and B combined are dominant in the Midlands. Only in the South are there a large number of households in the higher Council Tax bands. So in most parts of the North, at least, Council Tax bands do not offer a mechanism to prevent an increase in the cost to poor households due to more separate waste collections for recycling. It would be necessary either to increase benefits or for central government to provide funding for the entire additional cost for recycling (about £1.6 billion per annum, according to the Strategy Unit report) out of progressive general taxation.

4.3 Other incentive schemes

Recent research (Parfitt, 2002) suggests that socio-economic variables (including or closely correlated with income) do not significantly influence household waste arisings. The same research confirms that these arisings nevertheless vary greatly according to local authority, from about 15 to over 30 kg/household on average per week. The lowest amounts are found in local authorities that have refuse systems based on sacks or 140 litre bins, and which encourage home composting (the easiest way to take a large mass of waste out of the official waste stream). The largest

amounts are found in local authorities that provide 240 litre bins and do not encourage home composting. The analysis showed that once the amount of waste taken to civic amenity sites was included, the difference was much less stark. Since car journeys to civic amenity sites impose an environmental impact of their own, they are less desirable than local authority collection. Poorer households are less likely to have a car and more reliant on local authority collections.

It is not clear whether the Strategy Unit's recommendation about variable waste charging would lead to charges above current waste charges for those households who do not reduce and recycle, or charge reductions for those that do. Given that recycling is more expensive than disposal, the latter would require substantial resources from elsewhere (needing to fund the required schemes from reduced waste charge revenues). It may be noted that public perceptions, that recycling saves local authorities money rather than increases costs, are at variance with reality and might be a barrier to increasing waste charges to fund recycling schemes (Resource Recovery Forum, 2002). It is generally perceived that it is necessary to have effective recycling facilities in place before variable charging is introduced (Resource Recovery Forum, 2002), or at least for them to be introduced in tandem with it (Enviros Aspinwall, 2000). There is thus a serious funding issue to be addressed *before* variable waste charging can be seriously considered, whether it is intended that the variable charges should eventually help to pay for the costs of recycling or not. Generating the tax revenues to pay for recycling may itself raise equity and distributional concerns, but these are not further explored here.

The simplest way of creating an incentive for recycling is to provide a flat-rate payment for households that do or a penalty for households that do not. In Switzerland and the American states of Connecticut and New Jersey, it is mandatory for households to sort waste for recycling. In theory, penalties are enforced against householders who persistently fail to do so, although in the American experience enforcement against households has been patchy. Such a measure could be unpopular, but sends a strong message that not recycling is socially unacceptable behaviour. The penalties can be used to fund enforcement. However, although recycling rates in Switzerland are among the highest in the world, recycling rates among households in New Jersey and Connecticut are not particularly high compared to those found in

some European countries. In much of Switzerland, householders must pay for each bag of residual waste that they produce. The highest recycling rates are in Flanders and the Netherlands, where sorting waste for recycling is not mandatory. About 85% of the UK population says that it is willing to recycle, although the proportion that actually participates is much lower. Mandatory recycling is a method of reaching the minority of the population that is not willing and the substantial proportion that is willing but not motivated enough to actually do it. However, such an approach has to be enforced in order to be effective.

The alternative to a stick is a carrot. There have been two recent experiments in London providing small cash incentives to households that do recycle, with some success in increasing recycling rates - by 27% and 34% respectively (Strategy Unit, 2002). Participation in the bring scheme on a high-density estate in Tulse Hill was still only 13% and 11% qualified for the £10 incentive by participating more than half the time. Payment increased participation in kerbside recycling from 34% to 41%, while 22% of households qualified for the £10 incentive by participating more than half the time. However, the money for such a scheme has to come from somewhere – on a larger scale, local or national expenditure would have to increase even further than they would in order simply to cover the additional costs of a more sustainable waste management system. There is also the question of whether it is appropriate to pay people to do something that some would consider a matter of social responsibility. The danger is that it might create an unenthusiastic attitude towards recycling, which could come to be regarded as a chore imposed by the state, rather than something done willingly.

Blaby District Council in Leicestershire is the one example of a local authority in the UK that has introduced a very restricted form of variable waste charging. In 2001, it decreased the size of the wheeled bins it provided from 240 litres to 140 litres and providing a 140-litre recycling bin on request. If the refuse bin is filled before the end of the week, householders can buy refuse sacks from the council or pay to rent a larger bin for an annual fee. There is a discount for households with five or more people. Only 7% of households took up these options. The amount of residual waste collected went down and the amount of recyclables collected by the kerbside recycling scheme increased by 55% (Strategy Unit, 2002).

Since 45% of British households now live in areas with 240 litre bin collections, the Blaby experience suggests that these local authorities could significantly decrease the amount of waste generated and promote recycling simply by copying these measures. However, simply reducing the capacity of bins to 140 litres would alone probably have a significant effect as it is believed that the large capacity of 240 litre bins encourages waste production. The disadvantage with such a measure is that it does not really create significant incentives to reduce waste production at the margin, particularly for smaller households. Current legislation in the UK prevents local councils from separately charging households for waste disposal, except for certain items mentioned in legislation.

5. Variable waste charging and regressivity

5.1 Analysing household waste production

Because household waste generation is not related to income, any kind of single-rate variable charge for waste generation, whether it is based on bags, stickers, volume, frequency or weight, will tend to be regressive. For example, if the waste charge averaged out at £50-100 per household across the income distribution, this would correspond in the average household in the lowest income decile to 1-2% of their expenditure, compared to less than 0.3% in the highest income decile. For those households in low income deciles which generated more than average amounts of waste, and had lower than average incomes, the waste charge percentage of their expenditure would be much higher.

On the other hand, it could be argued that if the scheme was structured so that people could reduce their payments by both reducing their waste and participating in recycling initiatives, this would give an opportunity for low income people (and others) to reduce their waste charges. On the other hand it would certainly be politically controversial if any proposed scheme were to end up more regressive than the current Council Tax-funded scheme.

The only previously available data on waste production according to size of household was from a one-week survey conducted for the Environment Agency (University of East Anglia et al, 2000). As would be expected, larger households tend to produce more waste. One-person households in the study on average produced 9kg of waste per week, two person households 13kg, three person households 17kg, four person households 17kg and households with five or more 18kg. These averages hide huge variations between individual households and enormous overlap in the amount of waste produced by households of very different sizes. The amount of waste produced by manual and non-manual households did not vary significantly. It should be borne in mind that the Environment Agency's figures are based on no kerbside collection of recyclables and a very low recycling rate.

A better and more reliable source of data became available at the end of 2003. It comes from a trial by South Norfolk District Council, using lorries equipped to weigh the waste produced by around 3000 households in the authority. A survey was conducted and sufficient data was collected on 244 households for their patterns of waste production to be analysed. The trial was conducted with collection of recyclable waste (green bin) and non-recyclable waste (grey bin) on alternate weeks. Due to technical problems with the weighing equipment, data was only collected for all households on eight occasions out of a possible thirteen for each kind of waste. The data was kindly made available by South Norfolk District Council. The authors wish to express their gratitude to Dr Andrew Lovett at the University of East Anglia for assisting in obtaining the data, cleaning it and converting into a usable format.

The 244 households provided information about the number of members of the household and the ages of each of them. The households' Council Tax bands were already known to the local authority. Information on Council Tax bands was the only socio-economic variable collected. Because all the homes were in the same small area and there was a good spread of Council Tax bands among the sample, it can be taken as a reasonable proxy for socio-economic status.

Table 5.1 Weekly production of residual waste in kilograms according to household size in the sample

Number of people	Mean	10 th percentile	20 th percentile	Median	80 th percentile	90 th percentile	N
All households	9.0	3.5	5.2	8.6	13.0	15.7	244
1	5.5	2.4	2.5	4.8	7.9	8.9	36
2	7.2	3.2	4.1	6.5	9.9	11.7	89
3	11.0	5.2	6.9	10.8	14.5	19.2	38
4	12.5	7.2	8.2	11.2	15.5	18.5	55
5	13.9	7.3	8.6	12.8	17.7	23.4	26

Table 5.2 Weekly production of total waste (residual+recycled) in kilograms according to household size in the sample

Number of people	Mean	10 th percentile	20 th percentile	Median	80 th percentile	90 th percentile	N
All households	15.0	8.1	9.6	14.4	20.1	23.0	244
1	9.9	5.6	6.3	9.2	12.3	14.8	36
2	12.7	7.8	8.7	11.5	16.3	19.7	89
3	16.5	9.3	11.6	16.4	20.3	24.8	38
4	18.6	11.9	14.3	17.6	22.6	24.9	55
5	20.5	14.0	14.4	19.4	25.3	29.1	26

Tables 5.1 and 5.2 above show that production of both total and residual waste varies considerably between households of the same size, typically around a factor of two between households that produce a little waste for their size and ones that produce a lot of waste for their size. Strikingly, one-person households at the 90th percentile produce more waste than five-person households at the 10th percentile.

Additional household members lead to additional waste, but the largest change in terms of both residual and total waste is from a two-person household to a three-person household, which seems to add around twice as much to waste production as an additional person does otherwise.

Multiple regression analysis shows that as well as the size of the household, the age of the members affects waste production differently, for both residual and total waste. 0-4 year olds and 25-44 year olds produce particularly large amounts of waste, 16-24 year olds and over-65s produce particularly little, while 5-15 year olds and 45-64 year olds are in between.

Council Tax band has absolutely no effect on total waste production in the multiple regression analysis, but another multiple regression analysis shows that households with higher Council Tax bands have a higher recycling rate. Households in higher Council Tax bands appear to produce slightly *less* residual waste than households in lower bands, even though the total amount of waste they produce is the same, because the wealthier households are recycling more.

Table 5.3 below shows that the average household recycling rate was 40 per cent, but there was a dichotomy where one or two person households had on average a recycling rate of around 45 per cent, while larger households (with three, four or five people) had on average a recycling rate of between 34 and 35 per cent.

Table 5.3 Recycling rate by size of household

Size of household	Mean recycling rate (%)	N
All	40	244
1	46	36
2	44	89
3	34	38
4	34	55
5	35	26

In Table 5.4 below, the recycling rate is presented according to Council Tax band. It can be seen that the rate does not increase systematically through the bands.

Table 5.4 Recycling rate by Council Tax band

Council Tax band	Mean recycling rate (%)	N
All	40	244
A	39	15
B	37	86
C	41	89
D	39	24
E	45	18
F	40	10
G	55	2

The multiple regression analysis including the size and composition of the households shows a stronger correlation of 0.177 (significance 0.003) between Council Tax band and recycling rate which is not apparent here. In the simple table above, the socio-economic effect is masked by the fact that households in higher Council Tax band homes also tend to be larger and larger households tend to have lower recycling rates.

The sample is too small for it to be possible to produce tables that disaggregate the households according to both size and Council Tax bands – the numbers of households in most squares would be too low to show a meaningful pattern.

If a system of variable waste charging by weight was introduced for residual waste and Council Tax reduced by the average amount that households pay at the moment, then in order to obtain revenue neutrality and assuming no source reduction the effect on households of different sizes would be as shown in Table 5.5.

Table 5.5 Gainers and losers among households of different sizes (households producing less or more than the mean amount of residual waste) with a simple system of variable waste charging by weight (assuming revenue neutrality and no source reduction)

Number in household	Gainers (%)	Losers (%)	N
All	57	43	244
1	92	8	36
2	76	24	89
3	37	63	38
4	30	70	55
5	26	74	26

Table 5.5 shows that most one and two person households would gain and most larger households would lose. The result would be a matter of some concern in terms of the regressive effect for larger low-income households.

The effect on households in different Council Tax bands is shown in Table 5.6 below.

Table 5.6 Gainers and losers among households in different Council Tax bands (households producing less or more than the mean amount of residual waste) with a simple system of variable waste charging by weight (assuming revenue neutrality and no source reduction)

Council Tax band	Gainers (%)	Losers (%)	N
All	57	43	244
A	84	16	15
B	55	45	86
C	55	45	89
D	39	61	24
E	65	35	18
F	56	44	10
G	100	0	2

Table 5.6 shows that there is no clear pattern to the progression of gainers and losers through the Council Tax bands. This is not surprising because multiple regression analysis showed that Council Tax band is not an independent predictor of household residual waste production. It should also be borne in mind that the proportion of households in each Council Tax band is particular to South Norfolk and not representative of the distribution found more widely.

However, the concern remains about the regressive effect on larger low-income households. The next section discusses how that could be tackled.

5.2 Reducing regressivity from variable waste charging

Of the four generic types of scheme the bag/sticker option seems to have merits on grounds of simplicity and low administrative cost, although it is not as precise as a weight-based system. The introduction of a weight-based system involves the purchase of new vehicles and makes collection slower as the electronically chipped bin that each household is given has to be individually weighed. One advantage of a weight-based system is that it is fairer as the items that are most easily recycled (metal and glass) or composted (kitchen and garden waste) are much denser than difficult-to-recycle waste such as plastic food packaging. The great advantage of a weight-based system is that it appears to lead to greater source reduction, particularly if biowaste (which tends to be dense) is charged for even if separated (although at a lower rate than residual waste in order to encourage separation). Even a small increase in source reduction appears, according to Eunomia's estimates (Eunomia Research and Consulting 2003), to make a weight-based system the cheapest option on balance. There is a good case for households without gardens to have separated biowaste instead taken free of charge in order to avoid penalising them for their inability to engage in home composting. A sack-based system could be introduced as an interim measure, with a move to a weight-based system when collection vehicles were approaching the end of their lives anyway.

It is impossible to make accurate predictions about the levels of recycling that could be expected nationally on the basis of a small sample like the South Norfolk one. Another factor to take into account is that variable charging reduces the *total* amount

of waste households produce, both residual waste and waste for recycling. The South Norfolk sample was not exposed to variable waste charging even though their waste was weighed, so the data does not tell us what the effect of that would be in the UK. What the data tells us is about the *distribution* of waste production between individual households of different types and different households of the same type – information that was not available before.

As noted above, a variable waste charging scheme would appear to be regressive in respect of low and high-income households which generate the same amount of waste. It would also penalise (perhaps unfairly) large households, which inevitably tend to generate more waste than small ones. Another issue is that making the charges cover the increased cost of more sustainable waste management means that a larger proportion of households would lose (because overall costs would have to rise). However, the reduction in waste production because of variable charging would at least partially offset the additional costs of more sustainable waste management and any consequent financial losses. Nonetheless, at present UK costs for residual waste disposal, the expected reduction in total waste production could not be expected to entirely offset the cost of the increased recycling that variable waste charging would lead to. Using Eunomia's figures, the average cost per household of waste management might be expected to rise to around £70 under pessimistic assumptions. Eunomia has calculated that, if the recycling rate was raised to around 30%, the average cost per household would rise to about £70 per year. If there was variable waste charging then less waste would be produced and a recycling rate of around 45% could be achieved for about £70 per year (Eunomia Research and Consulting 2003). Since the present costs of household waste management are about £1.2 billion per year, that is equivalent to an increase of about £500 million to £1.7 billion per year. As the Strategy Unit recognised, at least this kind of increase in expenditure will be necessary in order to meet the requirements of the Landfill Directive. If this increase in expenditure was to be funded through Council Tax at the same proportions of local to central government revenues as at present, central government would need to fund £375 million (three quarters) of the £500 million increase.

In any switch to variable waste charging, it would seem desirable that Council Tax bills should show the deduction from Council Tax of the entire waste charge, in order

to counter pervasive public perceptions of ‘double taxation’ or ‘double charging’ when variable waste charges are introduced. This would involve all households receiving the same reduction, whether they are in Band A or Band H – a progressive tax change, as noted above.

In order to counter the potential regressivity of the variable waste charge, those who are entitled to Council Tax Benefit could receive a payment equivalent to the average waste charge (varying according to local authority) to help with their waste costs. With electronic payment of benefits, this would be very easy to set up.

A potential problem with relying on Council Tax Benefit alone is that it only reaches a proportion of low-income people. Even many people on benefits are not eligible for it.

The amount of waste that households produce varies according to size. If it is assumed, as discussed above, that average waste costs will rise to £70 per year and the charges are per kilogram of residual waste then on average (and assuming no waste reduction) one-person households will pay £43 and on average couples will pay £56. If we assume that they have on average received a deduction of £50 in their council tax bill, the result is a difference of less than 15p per week either way.

In order to protect larger low-income households, it would be necessary to provide extra benefits for additional members. The average waste bill for a three-person household would be about £85 per year, so an additional £35 a year would be needed to compensate them. The average cost for each of the fourth and fifth members of a household would be about £12 per year. To compensate, 50p per week could be added to Child Tax Credit for all families on benefits and low to medium incomes. The cost of an increase of 50p a week would be approximately £165 million per annum. This would ensure that, on average, larger low-income households did not lose out from variable charging.

Most households on benefits probably have the time to properly sort their waste for recycling and so should be able to reduce their waste bill more effectively than other households. However, since it is known from the Environment Agency one-week

study that households in lower social classes tend to eat more packaged food and less fresh food, they may still produce more packaging waste. One-person households at the 80th percentile in their production of residual waste would lose about £11 per year and two-person households at the 80th percentile of residual waste would lose about £27 per year. If there was serious concern about the impact on those at the upper end of the waste distribution curve, there could be an increase of 25p per single person, and 50p per couple in Income Support, Job-Seeker's Allowance and Pension Credit, and in Working Tax Credit by 25p per claim. That would cost about £150 million per year.^v However, it is not clear that this would be necessary, since even most two-person households would not lose without any such benefit increases.

However, in order to protect larger low-income households, it would be necessary to provide extra benefits for additional members. The average waste bill for a three-person household would be about £85 per year, so an additional £35 a year would be needed to compensate them. The average extra cost for each of the fourth and fifth members of a household would be about £12 per year. To compensate, 50p per week could be added to Child Tax Credit for all families on benefits and low incomes. Based on the costs quoted by the Institute of Fiscal Studies for increasing Child Tax Credit by £3 per week, the cost of increasing it by 50p a week would be approximately £165 million per annum (Child Poverty Action Group, 2003).

If the intention was that no household below the 80th percentile would lose out, then the increase in Child Tax Credit would be slightly higher at 65p per child, costing about £215 million per annum. Child Tax Credit is not an efficient way of targeting only low income households because the withdrawal rate is low and many households on quite high incomes are eligible for some money. Another problem is that there is currently poor take-up of tax credits among working families (about 70%), although take-up is higher among those most in need and lower among those least in need. However, using universal Child Benefit would cost much more and give money to many families with no need.

It can be seen that the introduction of such a variable charging scheme to create a more sustainable waste management system while protecting the poorest households from additional cost on average would involve increasing the social security budget

by around £165 million per annum. If the intention was that 80 percent would not lose out even if they changed their waste disposal habits no more than other members of society, then the cost would be about £365 million per annum, for increases in means-tested benefits (£150 million) and Child Tax Credit (£215 million).

It may be noted that, under this scheme, central government would be spending through the benefits system about the same as the £375 million it would need to spend in support grants to local authorities to cover the additional costs of higher recycling rates, if these were to be funded through Council Tax. In reality, without variable charging, central government, local authorities and ultimately taxpayers would have to spend far more on waste management and probably still fail to meet the requirements of the Landfill Directive because the growth in waste production is unlikely to be restrained without it.

The biggest problem with using the benefits system as a compensation mechanism is that it works on a national level. The actual charges in different local authority areas will vary, so households in areas where the increases in charges are higher than average could still lose out. It would also be difficult to roll out variable charging in all areas simultaneously, so there would be anomalies if benefits were uprated while some localities had variable charging and others did not yet.

These calculations are based on the assumption that the entire cost of waste services moves to a per-kilogram or per-sack system. If there was instead a fixed charge for collection and a per-kilogram or per-sack charge on top of that then the distributional consequence would be that one and two person households would pay rather more and larger households would pay rather less. It would also reduce the marginal incentive for source reduction.

If a more sustainable waste management system is introduced *without* variable waste charging as an incentive for active participation, then if the additional costs are borne across all Council Tax payers, the very poorest households will be protected from increases through Council Tax benefit, but the rest of the additional cost will be shared fairly evenly among all Council Tax payers in most local authorities. It would be necessary to increase other benefits and working tax credits to prevent an effect

from increases in the regressive Council Tax. A simpler way to avoid regressivity would be for central government to cover the additional cost out of general taxation.

An important additional factor needs to be considered. Variable waste charging encourages waste reduction in a way that mandatory recycling or incentive payments for recycling do not. Waste reduction is better environmentally than recycling. It is also cheaper to achieve. Although it was not possible to model this in this project, it is likely that the savings to society from waste reduction due to variable waste charging are likely to outweigh the additional cost to the social security system of a compensation mechanism to protect families on low incomes from additional expenditure.

Given the low participation levels that kerbside recycling in the UK has, it is clear that something radical needs to be done to meet the kind of targets that the Strategy Unit has recommended. A variable waste charging scheme of the kind outlined here would help to meet these targets in a way that did not disproportionately affect the poorest households.

6. Conclusions

In order to reduce the amount of residual waste sent to landfill and increase recycling, and in the absence of considerable new financial support from central government, it is likely that waste disposal charges will need to increase substantially. If these increased charges are applied through the current charging mechanism - the Council Tax - then they will have a regressive effect, because the Council Tax is regressive. Moreover, the increase in charges would, like the current flat-rate waste disposal charge, do nothing to incentivise householders either to reduce their waste or to cooperate with recycling schemes.

Variable waste charging provides an incentive for both kinds of behaviour, and experience in other countries has shown that it can be expected to result in both waste reduction and an increase in the separation of recyclables. A potential concern about its introduction in the UK is that it might have a disproportionate impact on poor households, because the generation of household waste bears little relation to income,

and more affluent households tend to recycle more, thereby reducing their residual waste which would bear the charge.

If waste charging was removed from Council Tax by reducing the Council Tax for all households by the same amount (the average per household cost of waste collection and disposal), this would be progressive (i.e. poorer households would be proportionately better off compared to richer households). If a revenue-neutral variable weight-based charge was then introduced for all households, and there was no waste reduction, 92% of single-person households, and 76% of two-person households, would be better off, while most larger households would be net losers. Clearly more households of all sizes would be losers if the charges were set at a level to raise more revenue than is paid at present through the Council Tax, in order to cover the extra costs of increased recycling.

In the revenue-neutral case, with no source reduction, effective compensation for the extra waste disposal costs could be given through the benefit system to the great majority of households on means-tested benefits. The cost of compensating all those up to the 80th percentile of waste generation is estimated at £365 million per annum. Central government would be spending through the benefits system about the same as the £375 million it would need to spend in support grants to local authorities to cover the additional costs of higher recycling rates, if these were to be funded through Council Tax.

Of course, all households could reduce their waste disposal costs by reducing the amount of residual waste they generate, both by producing less waste in the first place and by separating out more waste for recycling. If these effects were pronounced (especially the former), then it is quite possible, on the basis of experience in other countries, that total waste disposal costs, and therefore total waste charges, would fall from their present level, thereby significantly reducing concerns about regressivity from the change in the charging system. Of course, it would be open to individual households to reduce their own waste charges in this way whether or not other households did so as well. Given that, unlike energy and water use for example, there is no obvious 'basic needs' level of waste generation, there would seem to be fewer arguments (assuming that convenient and effective recycling facilities have been

introduced) why households could not radically reduce their waste in order to reduce their exposure to variable waste charges. It is also not clear how, in the absence of such charges, it will be possible even to curb the growth of household waste in the UK, let alone reduce such waste from its present level. On the other hand, if household waste could be reduced, then the lower waste disposals could offset partially or completely the extra benefits needed to protect low-income households from the higher variable waste charges that have helped to bring it about.

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ⁱ http://www.valpak.co.uk/final/c/public/regs/regs_weee.html

ⁱⁱ <http://www.defra.gov.uk/environment/statistics/wastats/mwb0001/download/xlsdata/ws01tb05.xls>

ⁱⁱⁱ The Chancellor has subsequently announced that landfill tax would be increased by £3 a tonne per year from 2005-06 from £14 per tonne until it reaches £35 per tonne

^{iv} To ensure that increases in the landfill tax did not distort the market in favour of incineration at the expense of other options.

^v This figure is extrapolated from other calculations made by Holly Sutherland of Cambridge University for the project team.