

WASTE RECYCLING

- Current recycling activity in the UK
- Technical and economic potential
- National Waste Strategy and Policy Issues

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Recycling has been the subject of sustained parliamentary interest over the last few years, with enquiries by Committees of both Houses, set against the backdrop of increasing attention being given to issues of sustainable development. UK policy has been under detailed review and a consultation paper on a future National Waste Strategy has just been issued in which policy on recycling forms an important part. Despite this attention, levels of recycling in many UK materials remain low relative to some other EU States.

This short report thus looks at the current extent of waste recycling, the technical potential for increasing the amount of waste recycled and issues arising¹.

CURRENT EXTENT OF RECYCLING

The Department of the Environment (DoE) assigns the 400 million tonnes (Mt) of solid wastes produced in the UK each year to 8 broad categories (Figure 1). In terms of general policy on waste disposal, the Government has adopted the EU hierarchy of waste management options which makes waste reduction at source the preferred option, whereby process changes are exploited to eliminate or reduce waste. The second choice is reuse, such as in the reusable glass milk bottle. After reuse, comes materials recycling and other means of recovering value from the waste (e.g. via energy recovery from waste incineration or by composting). Finally,

1. This paper is based on a review carried out to assist the House of Lords Select Committee on Sustainable Development in its current Inquiry.



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TECHNICAL REPORT

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March 1995

POST reports are intended to give Members an overview of issues arising from science and technology. Members can obtain further details from the PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (extension 2840).

Figure 1 ANNUAL WASTE ARISING IN THE UK

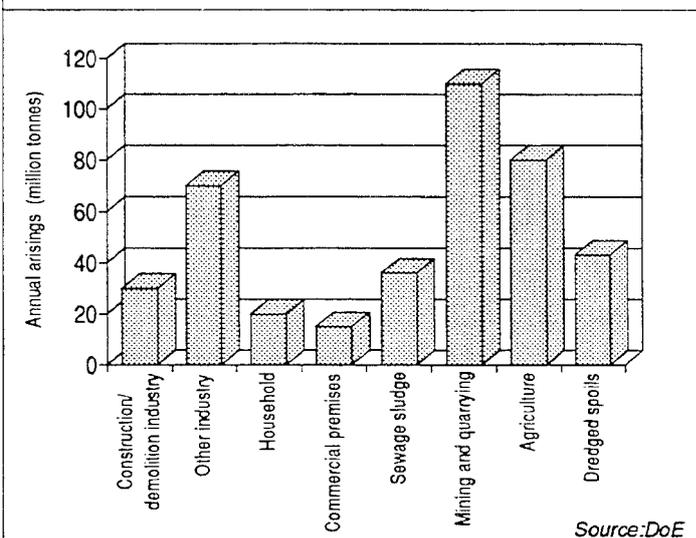


Figure 2 MAIN DISPOSAL ROUTES FOR UK WASTE

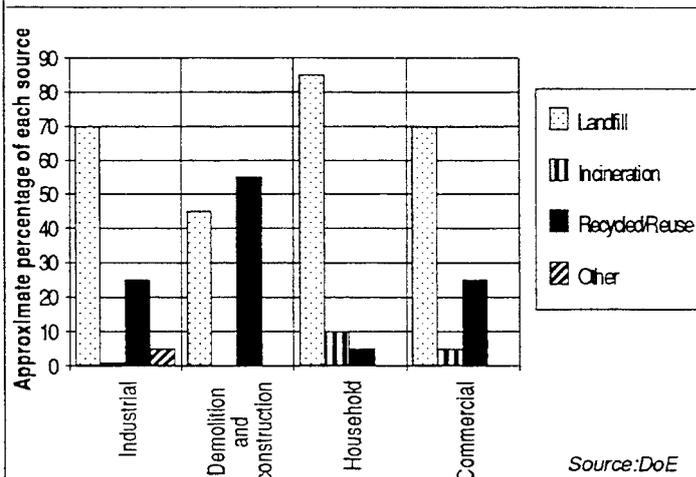
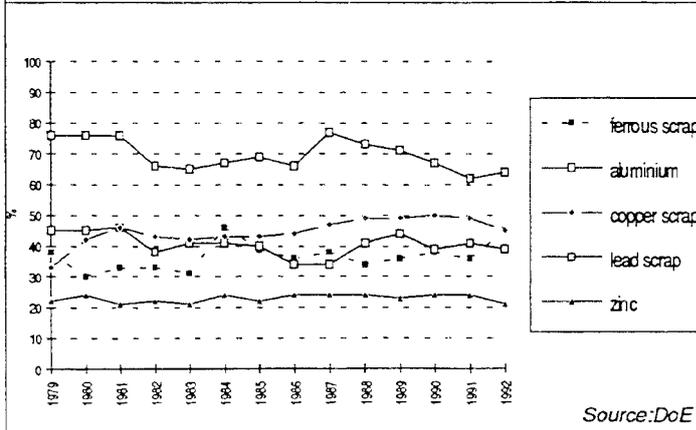


Figure 3 PERCENTAGE OF SCRAP REUSED



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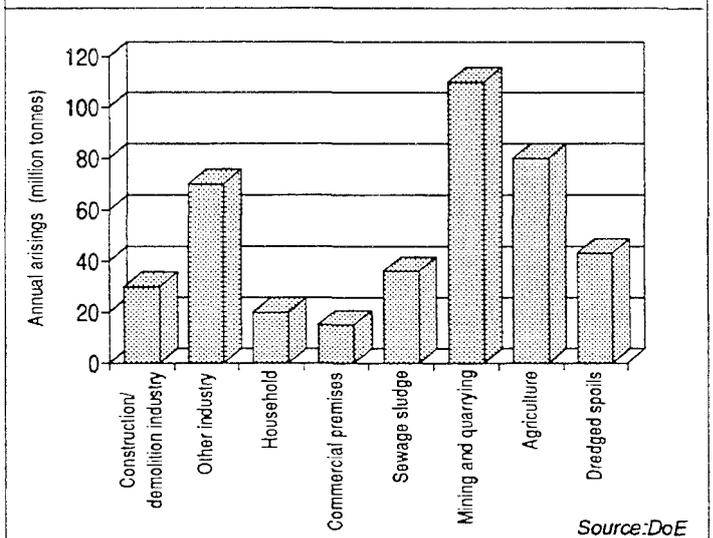


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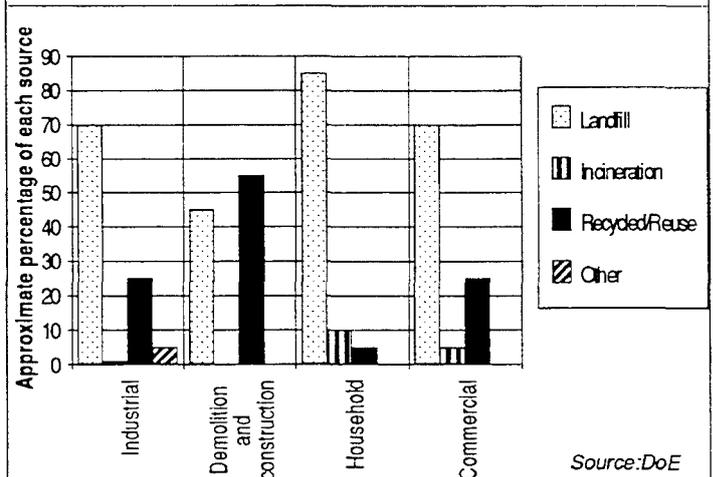
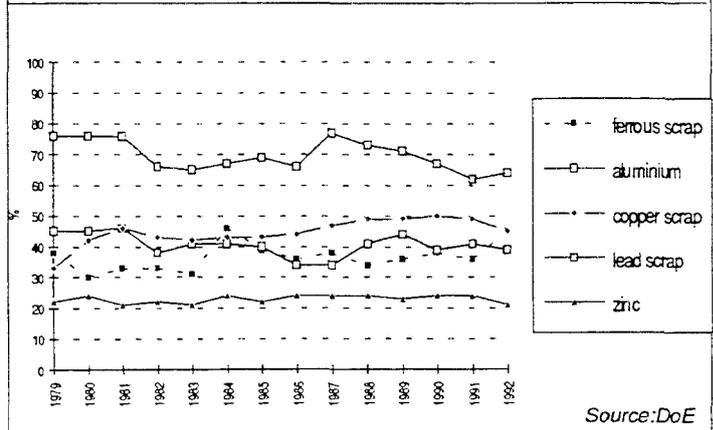


Figure 3 PERCENTAGE OF SCRAP REUSED



Box 1 POLICY DEBATE ON RECYCLING 1990-4

The main legislation relevant to recycling was contained in the Environmental Protection Act (EPA) 1990, which revised the regulatory framework for the management of waste. The Act introduced the notion of "controlled waste" which applies to construction, demolition and other industrial waste, household and commercial waste and, in most circumstances, sewage sludge. The Act imposed, for the first time, a **duty of care** on all those involved in producing and disposing of waste to ensure that it is managed appropriately. A framework setting stringent standards for waste disposal and pollution control was created and the concept of **Integrated Pollution Control** introduced to take into account the effects of pollutants on all media (air, water and land).

The Act also introduced new powers and requirements on **waste management licensing**. LAs can no longer act as both regulators and disposers, being obliged to separate these functions. Furthermore the Waste Disposal Authorities have been required to divest themselves of their operations either to licensed private companies or Local Authority Waste Disposal Authorities. Waste Collection Authorities have also been made subject to compulsory competitive tendering. A requirement to judge the technical competence and financial standing of operators of waste facilities was introduced along with a requirement for operators to obtain a certificate of completion before surrendering a waste management licence.

With regard to recycling, under the Act, the Government set a target of recycling half of all "recyclable" household waste by the year 2000; this equates to 25% of all household waste. To support this target, all local authorities were required to produce **recycling plans** and a system of **recycling credits** was introduced to be paid by waste disposal authorities to waste collection authorities (and in some cases voluntary organisations) whose recycling activities reduce the costs of disposal to the WDA. This is intended to provide an incentive to recycle more, and in April 1994, the level of payment was increased.

Additionally, in 1991 a system of **supplementary credit approvals** was introduced to assist LAs invest in recycling and other waste recovery projects such as pilot schemes for kerbside collection of household waste and composting initiatives. £42M was made available between 1991 and 1994 with a further £15m promised for the current financial year.

In 1993, the **House of Lords Select Committee on the European Communities** inquired into Packaging and Packaging Waste. This looked at the distortions to the Single Market as a result of different national measures and concluded that without harmonising legislation, national measures acting as barriers to trade would continue to be introduced. It also warned that the waste hierarchy should not be viewed simplistically and took the view that under properly controlled conditions incineration and landfill could be appropriate options.

Also in 1993, the **Royal Commission on Environmental Pollution** published a report on "Incineration of Waste" which looked at the role of incineration in dealing with the UK's waste. This concluded that incineration, followed by landfilling of the solid residues could be one best practicable environmental option for municipal waste. It also called for a national strategy for waste management.

In the Summer of 1994, the **House of Commons Environment Committee** published a report on Recycling which considered the need to take a more systematic approach to recycling and energy recovery. The Committee called for the preparation of a national waste management strategy and suggested that regional recycling targets might be more realistic than the national 25% target. It is also called for an early decision on whether the Government would legislate in support of the Producer Responsibility Group's Plan.

A further study by the **House of Lords Select Committee on Sustainable Development** began in 1994 and is still ongoing. One of its tasks is to look at the strength of the Government's approach to sustainable development with regard to waste recycling and disposal.

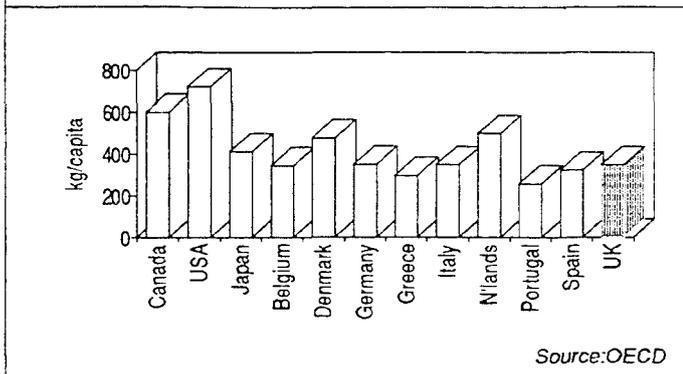
waste disposal, the last resort option, covers incineration or landfill without energy recovery, chemical treatment etc. This hierarchy forms part of the Government's 1994 Strategy for Sustainable Development which describes the key objectives of a sustainable waste strategy as being to "*minimise the amount of waste which society produces, to make the best use of the waste that is produced and to minimise resulting pollution*".

The actual disposal routes for all types of UK waste are shown in **Figure 2**, which reveals the continued dependence on landfill, despite this being the option of lowest preference. Levels of recycling vary greatly. Demolition and construction waste are extensively recycled. In addition, the UK has a well-established reclamation industry which recycles glass, metals, plastics and paper products with recycling levels ranging from 3 - 30% (see **Figure 3**). Currently, around 5% of household and 25% of commercial is recovered in some way.

Although there is still scope for waste reduction and increasing the amounts recycled within industry, much of the public debate in recent years has been over the extent of recycling of household and packaging waste. Some of the main events and policy measures over the last four years which bear on this are summarised in **Box 1**. In particular, the Government's 1990 Environment White Paper set the oft-cited target of recycling half of all recyclable household waste by the year 2000, a figure which is equivalent to about 25% of all household waste.

The amount of household waste varies from year to year but is currently around 20 Mt (5% of total waste nationally), while around a further 14 Mt (4%) arises from commercial premises - giving 34 Mt of 'municipal' waste. As far as household waste is concerned, each UK household generates an average of 600 kg of waste each year, although individual amounts vary widely depending on location, lifestyle, purchasing habits, the method of collection (bin or plastic bag or wheeled bin), the type of domestic heating and the size of gardens. By comparison with other countries (**Figure 4**), the amounts of municipal waste generated per capita (348 kg) are considerably below those for the USA, Canada and the Netherlands, on a par with those of Germany, Italy and Belgium, and above those for Greece and Portugal.

Figure 4 HOUSEHOLD WASTE PRODUCED IN DIFFERENT COUNTRIES



As was seen in Figure 3, UK recycling levels for most of the components of municipal waste have grown in recent years. For instance, in the glass industry the amount of scrap used in glass container production rose from 8% in 1984 to 29% by 1993. The recycled content of newsprint rose from 26.8% to 30.89% between 1990 and 1993. However, these figures are still low when compared with levels of recycling in some other European countries. By 1991, Switzerland, Netherlands and Germany were recycling 71%, 70% and 63% of their glass respectively (in part because of the large wine bottle market). As far as paper and board from municipal sources are concerned, in 1990 Switzerland recycled 49%, Netherlands 58% and Germany 43%. The comparable figure for the UK was 31%.

THE POTENTIAL OF RECYCLING

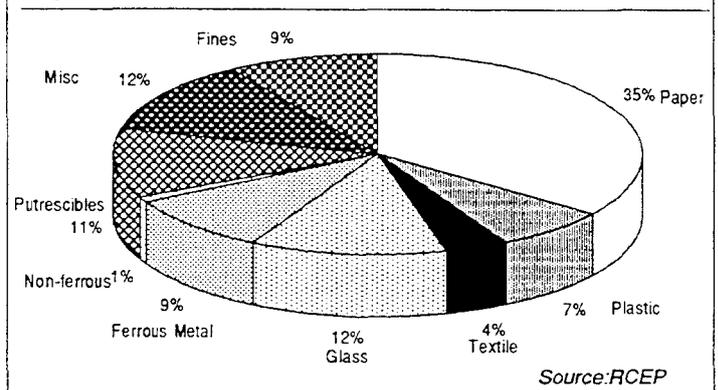
Before policies can decide what level of recycling should be sought, it is important to recognise any inherent technical limitations. As far as household waste is concerned, the DTI's former Warren Spring Laboratory (WSL) had carried out research for some years into the composition of typical household refuse (Figure 5) and which components (paper, card, glass, plastics, putrescibles etc.) were potentially recyclable, based on the practicality of actually separating the waste components without undue contamination. This analysis concluded that potentially 52% of dustbin waste generated each year is recyclable, and this figure underpins the government targets already described, which were to recycle half of all "recyclable" household waste.

The different fractions of the waste require different technical approaches, the three main candidates being separation of recyclable materials, composting and energy recovery.

Separation of recyclable material

Materials which can be separated for recycling include glass, plastics, steel cans, aluminium cans, waste paper, and paper and board. Various schemes have been set up for recovering these components, following four main approaches:

Figure 5 TYPICAL COMPOSITION OF HOUSEHOLD REFUSE



- Volunteer group collections (newspapers, cans etc.).
- Individual members of the public returning bottles, cans, paper to 'banks' in (pub or supermarket) car parks, garages, recycling centres etc. (so-called 'bring' systems).
- Some Local Authorities² operate "collect systems" which require householders to segregate materials as part of the LA's rubbish collection.
- Other LAs operate "centralised segregation" where materials are segregated after collection; the remainder may then be incinerated (with energy recovery).

The above differ in their effectiveness and cost. The 'bring' systems are the most cost-effective and generate profits of £6-12 per tonne recovered. However, so far they have only diverted relatively small amounts of waste to recycling (4-8%). LA 'collect' schemes recover much more material but at a cost. Sheffield was the first city to introduce a multi-material collect system and by the summer of 1994, such schemes were operating in Milton Keynes, Leeds, Bury, Adur, Devon and Cardiff. WSL found that such kerbside collect systems diverted to recycling 13-27% of household waste, but at a cost of £65-130 per tonne, and Nottingham County Council calculated that a collect-type system could cost £10 per household per annum compared with their existing expenditure of £1 for a high density bring system. The fourth approach (central sorting) can achieve comparable diversion rates to the kerbside collection systems but at lower cost (£63-82 per tonne recovered).

Composting

Composting uses natural decay processes (via bacteria, worms, fungi etc.) to turn the organic fraction of some wastes into a compost for mainly horticultural applications. While conceptually simple, there are technical difficulties, problems of avoiding contamination from other parts of the waste (e.g. glass and plastics) and

2. Local authorities are responsible for collecting and disposing household waste and, if requested, commercial waste. Individual authorities may be Waste Collection Authorities (WCAs), Waste Disposal Authorities (WDAs) or both. WDAs are now required to carry out their functions through contractors and these may be local authority waste disposal companies (LAWDCS), private contractors or joint ventures.

difficulties in finding suitable end markets. Much of the research in the UK on composting was performed by WSL whose work suggested that it would be most efficient to separate "green waste" from the municipal waste stream. Indeed, this is essentially what has happened in the UK, with most composting activity carried out by local authorities on wastes from parks, gardens and civic amenity sites, with 30 such schemes currently in operation around the country. The recent consultation paper on a National Waste Strategy (see later) envisages 75% of LAs promoting composting schemes by 2000.

With the approaching deadline (1998) for banning the disposal of sewage sludge at sea, the feasibility of composting sludge is also gaining greater attention. Wessex Water has opened a composting plant for sewage sludge at Avonmouth based on the Swiss Combi process already widely in use in continental Europe. The amounts of heavy metals in the sludge can, however, restrict the compost to use in landscaping or land reclamation (rather than for agriculture or horticulture). Research however continues. A composting project, "WyeCycle" which is linked to related work by Wye College, University of London was funded by DoE. In addition, a DTI project funded under the Environmental Management Options Scheme (DEMOS) has investigated the feasibility of co-composting municipal solid waste and sewage sludge. However, the composting process did not produce a marketable product and its co-sponsor South West Water decided not to build a commercial plant.

Energy recovery

Energy can be recovered in a waste incinerator (waste to energy plant) and the recovered (or "recycled") energy used for providing heat to adjacent buildings and/or for producing electricity for the national grid.

Four of the UK's 30 municipal solid waste (MSW) incinerators are able to recover energy from waste. Edmonton produces 27 MegaWatts (MW) for the National Grid, Coventry has recently been converted to generate electricity as well as heat and now exports 8MW, Nottingham is part of a city-wide combined heat and power scheme (CHP) and the Sheffield incinerator produces hot water which is sold to the city centre district heating scheme. DoE estimates that the 20 Mt household waste disposed of annually could, if it were all incinerated, provide energy equivalent to 8 Mt of coal. If industrial and agricultural wastes were included, this would rise to ~30 Mt of coal (equivalent to 10% of the UK's primary energy requirements).

The Government has set a target of 1500 MW of new renewable electricity generating capacity by the year

2000, and waste to energy is regarded as one of the more promising methods of meeting this. Waste to energy plant is encouraged through the Non Fossil Fuel Obligation (NFFO) which places a requirement on regional electricity companies in England and Wales to take a prescribed amount of electricity from non-fossil fuel sources. Under the various competitions ("Orders") held under NFFO, a given amount of capacity at a premium price has been available for operators proposing to generate electricity from waste, and by May 1994, 15 waste to energy schemes had been contracted under the first two NFFO Orders. Seven are due to be in operation by 1995. Together with the existing waste to energy schemes above, these would utilise just over 4 of the 20 Mt of municipal waste available. In the latest round of orders (the end of 1994), a further 22 schemes were announced with a total capacity of 246MW.

The purpose of NFFO is to 'pump-prime' an initial market, after which it is expected that there should be a steady convergence under successive Orders between the price paid under NFFO and the general market price for electricity. During the first 2 orders, waste to energy proposals were awarded contracts at ~5.55p/kWh, double the typical pool prices of 2.5-2.8p/kWh. In the latest round, the average price had fallen to 3.84p/kWh.

Looking to the future, there are a number of trends potentially affecting incineration costs. The economics of energy recovery might benefit as a result of the recent proposals to introduce a landfill levy from 1996, which will make landfill more expensive and increase the savings made by incinerating waste. At the same time, however, more stringent EC rules on emissions will come into effect by the beginning of 1997. While new proposals will have been made taking these into account, some older incinerators will have to close. In addition, many of the new schemes have not yet come to fruition due to local opposition and planning and other delays. There is thus some uncertainty over the overall effect of these competing pressures on the future amounts of household waste incinerated for energy recovery.

RECENT POLICY MEASURES

Parliament

Waste management has been the subject of several recent Parliamentary scrutinies, two of which are particularly relevant to materials recycling (Box 1). In 1993, the House of Lords Select Committee on the European Communities published a report on Packaging and Packaging Waste which addressed the distortions to the Single Market as a result of diverse national measures. In the summer of 1994, the House of Commons

Table 2 DETAILS OF RECYCLING INITIATIVES IN THE PRIVATE SECTOR

SECTOR AND EXAMPLE OF SCHEMES / FEATURES	RECENT FIGURES AND TARGETS
<p>GLASS Bottle Bank Distinct markets for different colours; more green glass collected than other colours, but markets still sufficient. Uneconomic to transport far due to low costs.</p> <p>ALUMINIUM Aluminium Can Recycling Association Scheme Established industrial process due to high value and large energy savings. Confidence that recycling rate will increase due to opening of Alcan remelt plant in 1991 at cost of £28M with capacity to handle 60,000 tonnes per annum (3,900M beverage cans). New ten-year plan for recycling of aluminium foil. Obstacles to greater recycling rates are education and ability to collect sufficient material.</p> <p>STEEL Save-a-Can Magnetic extraction and recycling long established as integral part of production process; many steel products, including cans used in packaging, contain up to 25% recycled steel. Increased capacity at Hartlepool and Llanelli for preparing cans for recycling by de-tinning. Industry believes that optimising recycling rates depends on establishing more centralised facilities where magnetic extraction can take place efficiently.</p> <p>PLASTICS Recoup (bottles), Save-a-Cup (vending cups) Recycling of non-manufacturing waste is relatively new. Problems have been a lack of markets for recycled products, the very low weight of each item and contamination of plastic packaging in household waste. Necessity to recycle different types of plastic separately also a problem, e.g. there are three types of plastic bottle and single bottles may be made of different types of plastic. Industry considers energy recovery the best option.</p> <p>PAPER AND BOARD Distinct markets for different types, e.g. carton, board, newsprint, tissues. Hit badly by unilateral measures in some countries to boost recycling and recovery. New mill being built at Aylesford which will produce 100% recycled newsprint. Cost of plant is £250M (of which £20M has come from DoE and DTI).</p> <p>MINING AND CONSTRUCTION Use of mineral and demolition waste materials by construction industry set to rise as a result of DoE's request, in April 1994, that the industry reduce its dependence on land-won aggregates from 83% to 68% by 2006 and to increase its use of secondary and recycled materials by 100%. Materials suitable for recycling include colliery spoil, china clay waste, slate waste, power station ashes, blast furnace and steel slags, demolition and construction waste and asphalt road planings. Stock-piles tend to be concentrated geographically; Therefore transporting it can be costly and cause pollution and nuisance. At end of 1980s, 10% of aggregates utilised were recycled or reused.</p>	<p>In 1993, 29% of glass container production was recycled equivalent to 501,000 tonnes. Target of 50% by year 2000.</p> <p>Cans recycling rate up from 2% (1989) to 20% (1993). Recycling rate for aluminium used in transport is 90% and in building is 70% Pilot schemes for recovering aluminium foil achieved rate of 9% in Sheffield and 6% in Cambridge. Target is 30%.</p> <p>In 1993, 13.3% of steel cans were recycled. Realistic target would be 37% by year 2000.</p> <p>In 1993, recovery rate of 3% and 3,150 tonnes bottles recovered. Overall, 5% of all plastics recycled.</p> <p>Recycled content of newsprint has increased from 27% in 1990 to 31% in 1994. Target of 40% by year 2000.</p> <p>Industry considers that, with Government support, recycled materials market has potential to rise from 25 to 30Mt per year to 50-60 MT per year by 2011 despite problems. The National Waste Strategy Consultation includes a target to increase the use of recycled materials as aggregates from 30Mt to 55 Mt by 2006.</p>

Environment Committee published its report on "Recycling" which explored ways of taking a more systematic approach to recycling and energy recovery. Waste disposal and recycling are also forming part of a current inquiry by the House of Lords Select Committee appointed to consider the UK Strategy for Sustainable Development.

Government

The main policy initiatives since 1990 were summarised in Box 1, but over the last few months, several additional announcements have been made by Government. Among these were an announcement that the new Environment Agency legislation³ would include provisions to support industry-led schemes to recover more packaging waste (see next Section) and prevent individual companies from escaping their obligations

(this accorded with the view of the House of Commons Environment Committee). Additionally, in the November 1994 Budget, the Government announced intention to introduce a landfill tax from 1996.

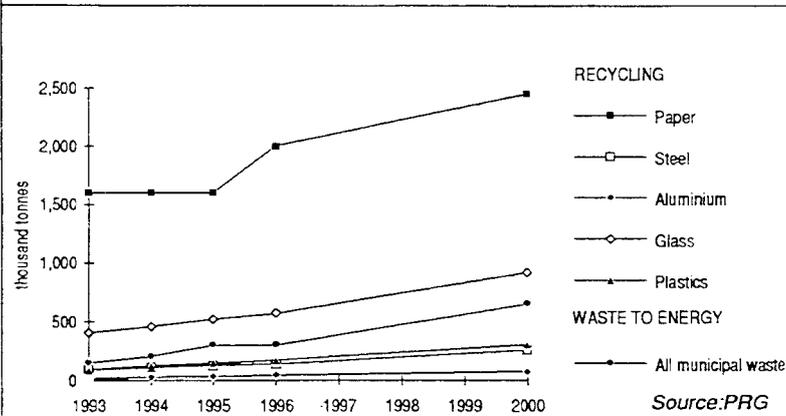
One of the central recommendations of the House of Commons Environment Committee was that a national waste management strategy be prepared as a matter of priority. This echoed a similar call from the Royal Commission on Environmental Pollution in its 1993 study on incineration. As a response, the Government has just (31st January 1995) published a consultation paper on a national waste management strategy for England and Wales, with a deadline of 28 April 1995 for comments. The paper contains a number of provisions relevant to recycling, including the relative priority of energy recovery and recycling, measures to increase the proportion of household waste recovered, recycling in industry and public advice and information (see Issues section of this note).

3. See House of Commons Library Research Note No 94/127 for more details.

Box 3 WORK OF THE PRODUCER RESPONSIBILITY GROUP

The **Producer Responsibility Group** was set up in 1993 as a result of a request from the Secretary of State for the Environment to submit a "plan to recover value from between 50% and 75% of all packaging waste by the year 2000". Its Plan, put forward in November 1994, has as its main thrust an undertaking to recover 58% of packaging waste by 2000, as well as individual material streams as shown in **Figure 6**.

Figure 6 PRODUCER RESPONSIBILITY GROUP INDIVIDUAL TARGETS



The Plan is based on the twin objectives of recovering as much packaging waste as is economically practicable from the industrial/commercial waste stream together with, on a more selective basis, increased collection from the domestic waste stream. In its operation, the Plan would need to complement other producer responsibility initiatives and national waste management plans and its systems should be fully integrated with those of other recovery systems in order to minimise costs.

The scheme is dependent on Government introducing legislation to put a legal obligation on the entire packaging chain to ensure that the initiative is not undermined by those seeking to avoid taking part. PRG also considers that, in view of the complex nature of the packaging industry and the associated recycling industries, the Government has a responsibility to ensure a "motivating economic and legal" base for the industry's efforts.

Following confirmation of the Government's commitment to the necessary legislation, an industry board would be set up, to be known as VALPAK, which would be dedicated to achieving recovery targets at a realistic cost. Additionally, "Material Organisations" (MOs) would be established for aluminium, glass, packaging, paper, plastics and steel, to oversee the packaging recovery concerns of all parties using that particular material.

PRG also considers that it would be appropriate for the new Environment Agency to act as a registration body for approved schemes such as VALPAK. In its operation, Valpak would be active in encouraging waste minimisation and also promoting energy from waste as an important and complementary option for municipal waste in general and, where appropriate, packaging specifically.

As far as funding is concerned, PRG believes that a levy on converters (those who convert raw material to a recognisable packaging product) should be introduced over the medium to long term. However, in the short term, the levy would be disproportionately costly to administer and VALPAK should find an alternative method of raising the initial finances.

PRG has now disbanded and been replaced by V-WRAG (VALPAK Working Representative Advisory Group). It is intended that this should be the precursor to VALPAK once the Government's packaging legislation has been introduced.

Elsewhere, Denmark has a ban on non-returnable beer and soft drink bottles, Holland a non-statutory "Packaging Covenant" and Belgium is considering introducing eco-taxes.

Private Sector

Various industrial sectors have set up their own initiatives and targets for dealing with some wastes. **Table 2** summarises the key features of these schemes and their effect on the extent of recycling.

A major private sector initiative was launched in September 1993 as a result of a request from the Secretary of State for the Environment to submit a "plan to recover value from between 50% and 75% of all packaging waste by the year 2000". This Producer Responsibility Group produced its final report in November 1994 and its principal recommendations are summarised in **Box 3**. Its main recommendation was that a recovery level of 58% of packaging waste could be achieved by the year 2000 providing the measures outlined in its Plan were adopted. Targets were also set for individual material sectors as described in **Table 2** and shown in **Figure 6**.

European Union

In December 1994, the EU Packaging Directive was finally adopted after much debate and 19 amendments by the European Parliament. The Directive requires 25%-45% of packaging waste to be recycled and other means (e.g. energy recovery) used to raise the total recovered to 50% - 65% within five years, after which the targets may be reviewed. A minimum figure of 15% has been set for individual materials such as glass and plastics. The Directive allows individual states to develop their own waste policies and these may include more stringent targets providing their policies do not distort trade or competition or damage other countries' compliance. Member states are also required to have sufficient facilities to process all of their own waste. PRG's Plan as it stands would more than meet these targets.

ISSUES

As described above, while some areas (e.g. glass) have seen significant increases in recycling in recent years, the amounts of material recovered by industry in many sectors have changed relatively little, and despite a range of recent policy measures, the amounts recovered from household wastes are ~5%. At the same time, changes in shopping patterns have actually reduced the extent of re-use by moves away from returnable containers - particularly

those for beer, soft drinks etc., but also for milk.

Various reasons have been given to explain why British recycling levels are not higher. These include lack of legislative pressure or economic incentives (until very recently). Other suggested causes are the provision of less than ideal recycling schemes, problems due to contamination of waste, lack of markets for recycled materials (recyclates), technical standards/specifications which prohibit the use of recyclates in products and insufficient public education. These and other issues are discussed below.

Recycling in the Hierarchy

While supporting recycling, groups such as Waste Watch argue that the high policy profile given to recycling has diverted attention from the unexploited potential of **waste minimisation and re-use**. Recent experimental schemes (Box 4) suggest that minimisation programmes not only benefit the environment but can also lead to financial savings, and the Centre for Exploitation of Science and Technology estimates that lessons learnt could, if applied to all British industry, lead to savings of £1B p.a. In some respects, waste minimisation is subject to similar market inefficiencies to energy efficiency, where many economically attractive schemes are not implemented because of lack of information, low management priority, a perception that the issue is peripheral to the main thrust of business and other factors. For instance, a recent survey showed that half of 420 companies still had no plans to reduce the amounts of waste generated despite the anticipated increases in the cost of landfill.

The Environment Committee has called on the Government to establish a national industrial waste minimisation scheme, and a DTI/DoE Advisory Committee on Business and the Environment has set up a Waste Minimisation Working Group to look at the barriers preventing firms from implementing relevant principles more widely. In October 1994, the Group recommended that the Government should provide advice on waste minimisation to small firms through consultants as well as through existing channels such as Business Links. The Government already supports the Environmental Technology Best Practice Programme, launched in June 1994, under which ETSU (the scheme's contractors) provide advice to firms; in addition it agreed that Business Links and other sources of DTI advice should make promotion of waste reduction a priority.

Other options would be to take the energy efficiency field as a model and to broaden the remit of the Energy Efficiency Office to 'resource and energy' efficiency and

Box 4 INDUSTRIAL WASTE REDUCTION SCHEMES

The Aire and Calder project was launched in March 1992, prompted by a report from the Centre for the Exploitation of Science and Technology (CEST) which warned that many firms, faced with regulatory pressures to improve their effluent discharges, were contemplating costly end-of-pipe investments without considering the scope for cheaper effluent reduction measures." The project involved 11 companies being helped by consultants to cut water consumption and effluent generation.

The project found over 500 opportunities for savings with a combined potential savings of about £4M; 90% of them having a pay-back of two years or less. Water consumption and effluent generation could be cut by 10-15% immediately but there was scope for further reducing water usage by 25% and effluent production by 40%. 40% of the measures would bring savings in raw material utilisation.

A waste minimisation project on Merseyside, known as "Project Catalyst" ended in June 1994 having involved 14 companies from a wide range of industries (chemicals, food processing, electronics, services and light manufacturing) again working with a consortium of consultants to reduce waste arisings and save costs. The project found potential savings of £8.9M from 399 waste reduction opportunities. In most cases, these measures would cost nothing and would have a payback of less than one year. Good housekeeping techniques accounted for nearly one-third of the options while technology modifications would account for almost 40%. The remainder could be accomplished through re-use and recycling of wastes, product modification and substitution of raw materials.

provide advice and grant assistance on waste minimisation and recovery in the sectors with which it currently deals. Existing WRAs and the new Environment Agency could advise on waste minimisation etc. to the Scheduled premises and processes and other sites which will come under its remit.

One policy lack in the UK identified by the Environment Committee and others is any overall sense of a quantitative national target for **waste minimisation**. Indeed, the PRG review of packaging waste envisages that amounts of packaging waste will rise by a further 10% by 2000 as a result of economic growth, demographic changes, increased consumption of convenience foods and increased health and safety standards. Such targets could be on a *per capita* basis, value basis or on overall total produced. In this respect, the Netherlands has a National Waste Strategy which includes a target for a 10% reduction in the amount of waste generated in the first place. The Waste Strategy Consultation document now proposes that household waste be stabilised at its current (1995) levels, though without specifying a date by which this should be achieved. Setting targets in other areas is seen as desirable but limited by the availability of sufficiently reliable statistics on which to base such targets. A task force has been set up in DoE to oversee the collection and analysis of

information to underpin future developments in the Strategy.

As already pointed out, reuse of beverage containers has been in decline with milk deliveries under pressure from carton sales in supermarkets, the move to 'disposable' bottles and an absence of deposit schemes still operating in some other countries. Moves in the other direction include reusable/ refillable packaging for household items such as washing powders and liquids. Reuse attracts relatively little attention in the Strategy with cautions that the additional raw material and energy demands of producing stronger designs, recovering, cleaning and transporting reusable containers may not make reuse the best approach. The Strategy nevertheless recognises that deposit refund schemes can work with environmental advantage but attributes the decline in the use of returnable containers to consumer choice. Organisations such as Waste Watch argue that a levy on milk cartons and plastic bottles to reflect their environmental disadvantages over refillable glass bottles would encourage retailers to provide consumers with the choice of returnable bottles, and the Strategy expects to keep this option under review. The Strategy also includes a revival of earlier waste exchange schemes in industry and encouraging innovative approaches to re-use.

A specific question raised by the Government in its consultation paper is whether incineration with energy recovery should be seen as equivalent to materials recycling in its 'pecking order' in the hierarchy, or seen as tending towards 'disposal' and therefore less preferred. At present, the Government sees waste-to-energy as a form of recycling and has given such schemes a high priority through NFFO. However, many groups point out that the energy recovered is less than can be saved by efficient materials recovery and argue that its priority should be lower as a result.

Recycling Targets

Despite the fact that many national and international policies include specific quantitative targets or objectives, there is still considerable debate over how valuable they are and on what basis they should be set. A key question is whether there is an optimal level of recycling and how this should be defined and translated into target levels for recycling. Technically, it may well be possible to recycle half the contents of the household dustbin, but is this environmentally desirable or economically feasible?

Deciding objectively the overall desirability of recycling versus disposal for a particular product or material, requires a comprehensive comparison of the energy, resource and environmental impacts of the product, the recycling process and its disposal options.

Assessing these factors over the whole life cycle of the product (life cycle analysis) can be very complex, and is still at an early stage. The DoE has just issued the first of a series of contracts for life cycle analysis, looking at the environmental impact of disposing of a number of wastes in different ways. However, at present such studies require many assumptions and can only provide a guide to the relative attractiveness of different approaches rather than an objective guide to what should and should not be recycled. For this reason, it seems inevitable that policy must be based on wider considerations, including those of sustainable development, and that any targets will have to strike a balance between what is desirable in principle and what is achievable in practice.

As already mentioned, the Government set a (voluntary) target of recycling half of all "recyclable" household waste by the year 2000 - broadly equivalent to recycling 25% of all household waste. The Environment Committee felt that the 25% target had been useful in "achieving a step-change in the level of recycling" but that the target might be inappropriate (or prohibitively expensive) in areas where there are no major urban centres. The Committee thus recommended targets should be more closely related to local circumstances, for example by setting regional targets. In the National Waste Management Strategy paper, the 25% national target remains unchanged, although comments are invited on whether a more ambitious overall recovery target might be set. It is recognised that the 25% figure is not intended to apply uniformly to all local authorities, and individual LAs are free to set more ambitious targets.

As already discussed, however, there are huge differences between the costs of collecting and transporting waste in the different schemes for household waste, raising serious questions over the best strategy for the future. 'Bring' schemes are so much more cost-effective than 'collect' schemes that any mechanisms which can increase the relatively low recovery rates in the UK would be highly cost-effective. In this context, Germany and the Netherlands do achieve much higher recycling rates (70%) with mini-recycling centres at a very local level, and this experience suggests that there may still be considerable scope in the UK for highly cost-effective improvements in recycling rates.

Local bottle, paper and can banks have been set up in recent years, particularly in supermarket car parks, but there are still many areas where recycling requires a special journey (e.g. to a LA recycling centre) which many people are not prepared to undertake. Increasing recycling rates would be facilitated by making it easier (and less costly) to provide bottle and paper banks in pub car-parks, recreation grounds etc., so that it is

Box 5 EUROPEAN EXPERIENCE

Much controversy has surrounded the German Packaging Ordinance which requires producers to take back their packaging or arrange for it to be taken back. Industry responded to the introduction of the Ordinance in 1991, by setting up the Duales System Deutschland (DSD) to collect and sort all sales packaging. Participating manufacturers pay a levy to DSD for each item of packaging and mark their packaging with a green dot to show that payment has been made. Membership of DSD by manufacturers is not compulsory, but retailers exert strong pressure for the goods they stock to be part of the scheme. The Packaging Ordinance requires that, by 1st July 1995, 80% (by weight) of glass, tin, aluminium, cardboard, paper and plastics should be collected by DSD. Of the material collected, 90% of the glass, tin and aluminium must be recycled, and 80% of the plastics, paper and cardboard (incineration with energy recovery does not count as recycling.)

The French Packaging Decree was introduced in 1992 and requires all producers to contribute to, or engage in, the recovery of all packaging waste. Two companies have been set up for this purpose - Eco-Emballage SA (EE) for packaged waste in general and Adelphe SA for bottles. Unlike DSD, EE is not itself responsible for carrying out collection and sorting; instead it enters into agreement with municipalities. Contracts are arranged between participating municipalities and materials handling firms to take collected goods. The former receive an income from both EE and from the sale of material collected. EE's income is derived from a charge on packaged products which, although lower than in Germany, is normally mandatory on all producers of packaged goods. A major difference between the French and German schemes is that clean incineration with energy recovery is regarded as a legitimate form of recovery.

easier for the public to act on current levels of awareness of the importance of recycling. In this context the Strategy paper aims to provide 'close-to-home' recycling facilities for 8 out of 10 households by 2000. Another option to encourage further recycling at limited cost would be to encourage the voluntary sector by entitling such groups to recycling credits from WDAs (these are currently discretionary). The DoE has been reviewing this issue but has not proposed any changes in the consultation paper on the Strategy.

Many local authorities have also set their own recycling targets as part of the Recycling Plans which they were required to submit to the DoE by August 1992 under the Environmental Protection Act 1990. A survey in February 1993, however indicated that while 40% of local authorities planned to meet the Government's 25% recycling target, a third had not set a target at all while a further 10% had set a target level but not a date by which to achieve it. The system to encourage LAs to recycle employs recycling credits (Box 1) paid by the WDA to the Waste Collection Authority for each tonne of waste which it removes from the waste stream for recycling. A study in 1992/93 found that the credits had not yet made 'a statistically significant impact' on

recycling activity, but were believed to have propped up recycling levels at a time of falling secondary material prices and increased collection costs. Nonetheless, both the DoE and many LAs believed that increases in the level of payments should boost recycling rates.

These payments were increased in April 1994, but there are complaints that merchants and the secondary recycling industry have cut prices or increased charges, offsetting the benefits to the LA of recycling. The Environment Committee recommended that the DoE keep the issue of pricing and recycling credits under review, and undertake further investigation if firm evidence linking cuts in prices with the increases in credits was forthcoming.

Various industries (e.g. glass, paper and board, metal and plastic) have also established their own recycling targets as indicated in Table 2. However, most attention has been given to the Industry's Producer Responsibility Group (PRG) initiative to recover value from 58% of packaging waste by 2000. Some would be recycled as paper and board; some via incineration with energy recovery (Box 3).

While welcomed by many, there are uncertainties over whether this target is likely to be achieved by the year 2000 because of:-

- reduced funding relative to the initial proposals;
- market uncertainties - including the effects of the major recycling programmes in Germany;
- a substantial role is seen for incineration, which is dependent on others building the plants;
- the amount of packaging waste is expected to rise from 7.3 to 8 Mtpa by 2000, suggesting that the PRG sees only a limited potential for waste minimisation.
- Delays in the necessary legislation setting up the Environment Agency may also contribute.

Markets

The key to any successful collection scheme is to have adequate (in both size and price) markets for recycled products, and the problems which occur where recycling is promoted without ensuring that markets exist were shown all too clearly in Germany (Box 5), where surpluses of recovered paper and plastics were dumped in other Community countries causing a severe disturbance to European waste markets. To date, most Government efforts have been concentrated on increasing the amounts collected, in the belief that industry has an incentive to make sure that markets exist or are developed. This policy is supported by the Industry Council for Packaging and the Environment (INCPEN) who point to the entrepreneurial nature of the secondary

materials market and see regulations (e.g. on minimum recycle content) as distorting the market and potentially counter-productive.

DTI and DoE have funded some work on new uses for recycled material and the British Standards Institution (BSI) is looking at standards which unnecessarily impede the use of recyclates. Markets for recycled materials have increased but many are still very volatile - e.g. after a long period of apparent surplus in the paper market, the industry is now predicting shortages. The weakness in some of the markets and prices points to markets ultimately being the key limiter to the extent of recycling programmes.

Options for Government to encourage markets include:-

- Government departments are committed to use recycled products where they compete on quality and price, but no quantitative targets. One option would be to set a minimum recycled content (e.g. in the USA, a target of 20% has been set for all Federal paper purchases, rising to 30% in 1995).
- Setting more binding industry targets for the use of recyclates (e.g. by building on voluntary undertakings such as the newspaper industry's target of 40% recycle use in newsprint by 2000, and the PRG's objective of 58% packaging waste recovery by 2000).
- Taxation which favours secondary materials over virgin materials where environmental benefits would result.
- Removing standards which discriminate against recycled materials; there may also be benefit in developing standards for (new) recycled materials such as compost.
- Research into expanding the use of recyclates. For instance, Devon CC has awarded a small grant to develop work overalls from recycled fabrics. DoE and DTI have also funded research on new uses for recyclates.

Other Issues

The Waste Strategy Consultation paper covers much additional ground, including a discussion of specific waste streams such as waste tyres, batteries, chemical waste, agricultural waste, sewage sludges, mines and quarries waste and construction/demolition waste. Reviewing each of these areas is beyond the scope of this note, but some general issues do emerge.

Firstly, many roads are leading towards incinerators including ones for sewage sludge (diverted from dumping at sea by 1998), clinical waste, domestic waste, packaging waste, as well as industrial waste. Incineration has been scrutinised by the RCEP which concluded that given adequate technical controls, waste incinera-

tor emissions posed no significant risk to health, and accepted that incineration could be the best environmental option for municipal waste where energy is recovered. Nevertheless, there remain factors which could potentially affect the longer term sustainability of incineration including:

- Continued uncertainties over the health effects of dioxins in incinerator emissions. This is likely to be generate a serious debate following the draft US Environmental Protection Agency health assessment which characterises dioxins as probable human carcinogens which may also have effects on development, reproduction, and immune suppression at levels close to those to which the population is currently exposed. Work in the UK also shows that the processes which form dioxins are still imperfectly understood, emissions not therefore readily controlled, and limits therefore exceeded.
- The difficulty of raising the capital for the substantial number of plants required.
- Potential conflicts between the proximity principle and the need to transport waste to central facilities to utilise economics of scale.
- Concern over cadmium and mercury emissions (from batteries, clinical waste, and other sources).

Secondly, the difficulties in developing appropriate strategies for recycling municipal waste and other major wastes such as sewage sludge show that targets for Research and Development (R&D) persist. Much of the internal Government expertise on municipal waste recycling, composting and other fields was resident in the DTI's Warren Spring Laboratory, closed in April 1994. Parts of this expertise were transferred to AEA Technology's National Environmental Technology Centre but DoE attempts to improve statistics, understanding processes, evaluate new technological options, as well as industry environmental advisory schemes have had to accommodate this change. In addition to projects supported by the DoE and DTI, there are potential avenues for the UK to participate more effectively in European collaborative R&D via Framework IV and the EUREKA programmes, both of which have environmental technology components; encouraging such participation could be a priority for the Environment Agency.

Finally, much of the recent parliamentary scrutiny has highlighted the need for better public education. Consumer behaviour is a product of consumers' own preferences and the choices which they are given (for example, those who would be willing to support a deposit scheme cannot do so if none is offered; equally willingness to take glass or paper to a 'bank' depends very much on the distance and ease of access). Most thus accept that public education needs to be seen as

part of a coordinated strategy for increasing choice/ decreasing barriers to recycling rather than an independent activity in itself. In this context, DoE found in a survey in 1993 that more people were already taking personal action for environmental reasons. For instance, 44% took bottles to the bottle bank (compared to 40% in 1989) 48% collected old newspapers (38% previously) and 48% used recycled paper (38% previously).

The National Waste Strategy recognises that an affluent society tends to become a 'throwaway' society, and that current charging mechanisms for waste disposal do not create any specific incentives to reduce or recycle waste in the household. As a consequence, DoE proposes to review publicity materials to encourage the public to think more of the consequences for sustainability of its purchasing and waste-creating activities - for instance by encouraging people to avoid 'conspicuous consumption', re-using products where possible, and by minimising packaging⁴. The Strategy places its emphasis on a non-regulatory approach and thus relies on the market to decide the range of choices within which consumers can exercise their heightened awareness of sustainability, and does not include any market instruments to encourage more sustainable practices, for example in supermarket packaging. Environmental groups see this, and the broader non-statutory approach as limiting the likely impact of the Strategy.

4. This has been stressed again by DoE in its recently-launched 'Going for Green' campaign, which seeks to encourage individual responsibility in all fields of environmental protection.

*

GLOSSARY

BSI	British Standards Institution
DoE	Department of the Environment
DSD	Duales System Deutschland
DTI	Department of Trade and Industry
EC	European Community
EE	Eco-Emballage SA
EU	European Union
INCPEN	Industry Council for Packaging and the Environment
kWh	kiloWatt-hour
LA	Local Authority
MSW	Municipal Solid Waste
Mt	Million tonnes
NFFO	Non-Fossil Fuel Obligation
R&D	Research and Development
RCEP	Royal Commission on Environmental Pollution
PRG	Producer Responsibility Group
WDA	Waste Disposal Authority
WSL	Warren Spring Laboratory

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