

Waste Hierarchy Guide

Applying the waste hierarchy:

A guide to business



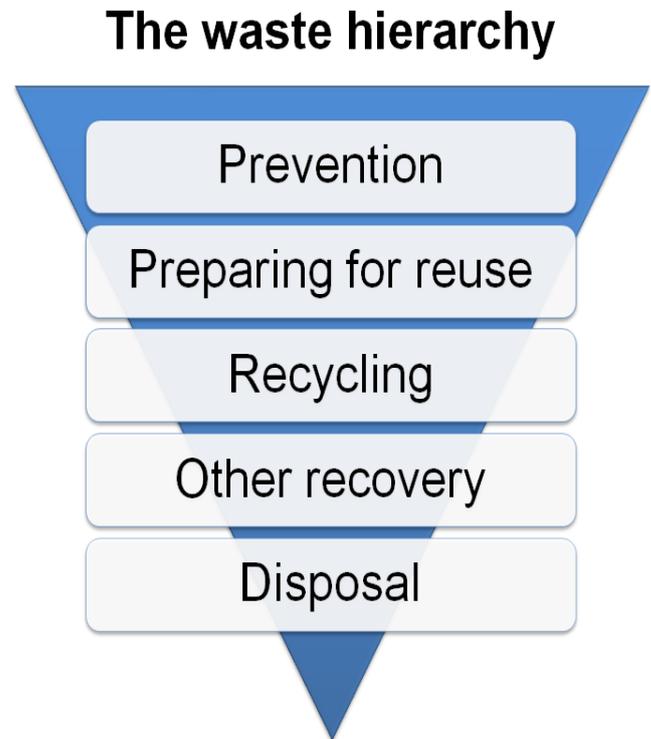
The waste hierarchy - what you need to know

Congratulations on requesting your tailored guide to the waste hierarchy from WRAP.

Every day UK businesses are literally throwing away profit due to the waste they produce. Many businesses are unaware of how significantly this impacts on their bottom line. Others just don't know where to go for practical confidential advice to help them make better use of their resources. A better understanding of the waste hierarchy will help you identify actions that can be taken to become more resource efficient.

As non renewable resources become harder to source and the demand for materials that we need to support a low carbon economy grows, it makes sense for businesses to adopt the new waste hierarchy shown to the right.

The most preferable option 'prevention' is at the top and there are a range of other options which should be applied, wherever possible, before the least preferable option of 'disposal' at the bottom.



The waste hierarchy - your duties

If your business or organisation (including local authorities on behalf of householders) produces or handles waste (this includes importing, producing, carrying, keeping or treating waste; dealers or brokers who have control of waste, and anyone responsible for the transfer of waste), you must take all such measures as are reasonable in the circumstances to :

- prevent waste, and
- apply the waste hierarchy when you transfer waste.

You must confirm by an additional declaration in the Duty of Care waste transfer notes (and Hazardous Waste Consignment notes) that you have taken all reasonable measures to apply the waste hierarchy.

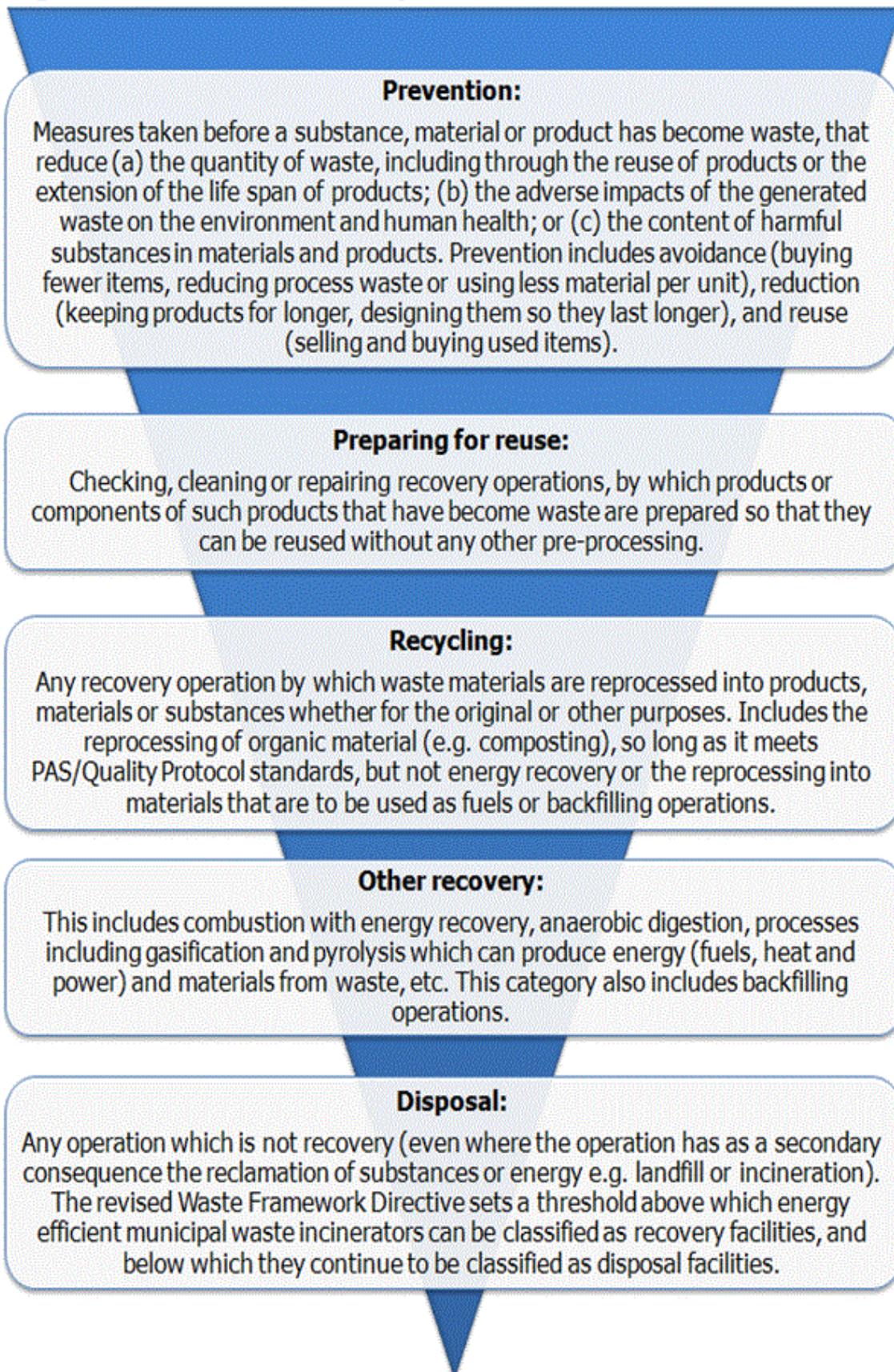
[Further guidance on your duty of care is available here](#) and your duties are set out at in **Regulations 12, 15 and 35 of the [Waste \(England and Wales\) Regulations 2011](#)** .

Part 1: Putting the waste hierarchy into practice

This guide supports better decisions on resource management on the **environmental impacts** of various waste management options for a range of materials. It is not designed to be a comprehensive list of your options, but provides some suggestions and guidance on how to apply the waste hierarchy.

Article 4 of the revised EU Waste Framework Directive ([WFD \(Directive 2008/98/EC\)](#)) sets out five steps for dealing with waste in priority order. These steps form the basis of the waste hierarchy shown in Figure 1, which illustrates the order of priority you should apply when making decisions about the resources used and the waste generated by your business.

Figure 1: The waste hierarchy



The waste hierarchy takes into account the impact of the different waste management options on climate change, air quality, water quality and resource depletion. The impact of transporting waste material and the energy generation methods used in England (our energy mix) have also influenced the development of this guide.

The decisions you are legally obliged to make to follow this waste hierarchy include identifying the best waste management approach for the specific waste your business generates. In addition to the environmental impacts of these decisions, you will also need to consider technical feasibility, economic viability and environmental protection.

It may be helpful to look at the following questions in turn and to discuss them when you negotiate waste management contracts:

1. What does the waste you create or handle consist of?
2. How can you prevent any of this waste?
3. Can the waste be prepared for reuse, can it be recycled or can any other value be recovered?
4. How can you or your waste contractor(s) help you to elevate your waste on the waste hierarchy scale?

Part 2: Specific waste guidance

This section is designed to help you understand what measures are available to you to apply the waste hierarchy, based on the material types you have indicated are relevant to your business.

In this document (as in the Waste (England and Wales) Regulations 2011 and the Waste Framework Directive), when we speak about '**reuse**', we mean using again a substance, product or material **before it becomes waste**. '**Preparing for reuse**' relates to checking, cleaning or repairing activities that allow **waste** to be reused without any other processing.

Paper and board

In 2008, the UK used 13.2 million tonnes of paper and board products and 8.8 million tonnes of paper and board were collected for recycling. Almost 40% of this was collected from the municipal waste stream, with the remainder coming from commercial and industrial (C&I) sources.

Waste hierarchy options for paper and board

Prevention

- Use less board packaging.
- Reuse packaging.
- Print less often.
- Print double sided.
- Sign up to the [Mailing Preference Service](#) and mydm.co.uk to reduce unwanted mail.
- Collect paper that has been printed on one side only or unwanted branded stationery to make notepads.

Preparing for reuse

- Segregate and shred paper for resale or donate for reuse as packaging infill.

Recycling

- Segregate waste paper and board for recycling, sorting by grade to maximise the cost-effectiveness of recycling collections.
- The [NetRegs Waste Directory](#) offers an easy way to find out where you can recycle or dispose of your business waste. You can search for licensed recycling and waste disposal sites in England and Wales and check what types of waste they accept.
- If you want to find a business to collect your waste or recycling, see [Find a waste carrier](#) .
- Paper and board may also be composted. For further information on composting, visit the Association for [Organics Recycling website](#) .

Other recovery

- Segregate paper and board and send for energy recovery.

Disposal

- Ensure you follow your duty of care responsibilities to manage waste correctly to enable its safe recovery or disposal without harming the environment.
- If you produce paper and board waste that cannot be handled by any of the options outlined above, consider using a compactor or bailer to reduce the volume of waste you send to landfill, hence reducing the frequency of collections required. Ideally paper and board should always be diverted from landfill.

Benefits of applying the waste hierarchy for paper and board

Prevention: Preventing paper waste, by reducing the use of paper in the first place or reusing paper, has significant environmental benefits in terms of greenhouse gas (GHG) emissions, resource use and energy consumption.

Preparing for reuse: Enabling others to reuse your ‘waste’ paper and board has similar benefits to those outlined above for the prevention of paper waste. It is likely that there will be some transport implications and you may need to undertake some activities to prepare your waste for reuse, such as segregating this waste and removing labels or commercially sensitive information. By preparing your waste paper or board for reuse and finding a useful outlet for this waste, you will be helping to reduce the environmental impact and costs associated with paper and/or board production.

Recycling: The available data suggest that recycling is preferable to other waste management options, even when the recovered paper or board is transported to China to be recycled. The benefits of recycling paper and board vary with grade; the higher the quality, the greater the benefit of recycling. Research consistently shows that more energy is saved by recycling paper and board (thus avoiding the use of virgin fibres) than by using waste paper products to replace fossil fuels in energy production. Typically twice the amount of energy is saved as would otherwise be produced.

Other recovery: Many recycling plants in the UK use sludge from the recycling process (fibres that are too short to recycle) to generate energy via combined heat and power (CHP). The energy produced is used to power the recycling process. Paper and board used to generate energy are classed as renewable fuels. They offset the use of fossil fuels, which provides environmental benefits in terms of avoided resource use and reduced contribution to acidification relative to landfill. Where paper is contaminated (e.g. with grease from food) it is less suited to recycling and more suited to energy recovery.

Disposal: Paper and board should be diverted from landfill wherever possible. As they degrade in landfill, they can emit methane. Even where some or most of these emissions are captured for flaring or energy recovery, the overall environmental impact is still negative.

Prevention Case Study: Reducing corrugated board weight without compromising performance

Packaging distributor Kite Packaging Ltd (Kite) wanted to cut down the amount of space in its warehouses taken up by corrugated board cartons, thereby improving logistical efficiencies, saving money and reducing the amount of board that goes into the household waste stream.

This gave rise to a project, funded by WRAP, in which Kite experimented with changing from double-wall flute cartons to a thinner, single-wall flute alternative. To ensure the thinner carton was as strong as the current one, independent compression testing was done by The Packaging Industry Research Association (Pira) and packaging manufacturer Svenska Cellulosa Aktiebolaget (SCA). As a result, two single-wall flute board grades were chosen for the range of stock cartons. These grades weighed less, but were of similar strength to the current double-wall flute cartons.

The calculated annual savings of the implementation of this project at Kite is 36 tonnes of paper-based packaging material, which equates to a reduction of 25 tonnes of corrugated board entering the household waste stream. If all other manufacturers and distributors of stock corrugated cartons adopted a similar

approach, a UK-wide annual saving of 3,600 tonnes could be achieved.

Recycling Case Study: Recycled paper comes to life and pensions

Friends Provident provides life assurance, income protection, pensions and investment products for individual and corporate clients in the UK. The company employs a total of just under 4,000 people at its five main offices across England and 12 area offices throughout the UK.

Introducing recycled paper for marketing print and other applications is diverting over 1,000 tonnes a year of waste paper from the waste stream. By switching to recycled paper, the company is stimulating manufacturers and distributors to further develop their ranges and availability of recycled alternatives. 'Going recycled' is closing the loop on paper recycling at Friends Provident by complementing the company's paper recycling system. Distribution of publications printed on recycled paper is raising public awareness of the opportunities to make productive use of recycled materials. The company is now actively engaged in extending its use of recycled paper even further (e.g. to direct marketing). Opportunities to introduce envelopes and business cards with recycled content are also being kept under review.

“The quality and performance of today’s recycled papers are a revelation – and completely comparable with virgin grade alternatives”. Denis Bayle, Marketing Services Support Manager, Friends Provident.

Wood

WRAP estimates that 4.7 million tonnes of wood waste were generated in the UK in 2008/09. However, this is likely to be an underestimate due to a lack of data from the construction sector and to be lower than previous years because of the economic downturn. The vast majority of wood arisings came from construction and demolition activities. Packaging was also a significant source. 619,000 tonnes of wood waste came from the municipal waste stream and slightly less from industrial sources.

Wood waste encompasses sawdust, doors, beams and planks, furniture, etc. Waste wood may be clean (untreated) or contaminated with additives such as paint, glue and preservatives or other material (e.g. nails). In some cases, treated wood is classified as hazardous waste and has to be managed accordingly. Recycling and recovery options for wood waste depend very much on the type of waste wood and how well sorted it is.

Waste hierarchy options for wood

Prevention

- Retain and use items for longer.
- Reuse items such as pallets, furniture and structural timber.
- Identify ways to reduce demand for wood (e.g. lightweighting products and/or packaging).
- Refurbish items where possible rather than replace.
- Sell or donate unwanted items.
- Buy second-hand and vintage items or take them for free from community organisations.
- Lease, rather than buy, items.
- Sell surplus construction stock (via <http://builderscrap.com>).
- Refurbish or repair wooden items (e.g. wood pallets).

Preparing for reuse

- Segregate surplus clean wood to be collected and reused or resold (for info visit www.communitywoodrecycling.org.uk).
- Segregate demolition wood waste for reuse (e.g. for flooring).
- Repair, donate or sell on wood furniture and fittings (via the [furniture reuse network](#)).
- Projects, such as Greenworks (www.greenworks.co.uk), collect and refurbish office furniture for resale or for educational facilities in developing countries.

Recycling

- Segregate wood according to the end markets for which it is suitable.
- The [Wood Recyclers' Association](#) provides information on wood recycling.
- [WRAP Guidance on separating wood for recycling at source is available by clicking here.](#)
- Visit recyclewood.wrap.org.uk to find local wood recyclers and the [NetRegs Waste Directory](#) .

Other recovery

- Collect uncontaminated waste wood offcuts and/or dust for use in an on-site biomass boiler or to send to large industrial power plants.

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- Compost uncontaminated wood waste.
 - Contaminated wood can be segregated and sent for thermal processing to an [Integrated Pollution Prevention and Control \(IPPC\)](#) approved energy-from-waste plant.
 - Some types of contaminated waste wood could be sent for energy recovery in a plant which is compliant with the EU's [Waste Incineration Directive](#) .
 - For a list of waste incineration compliant sites, click [here](#) .

Disposal

- Ensure you follow your duty of care responsibilities to manage waste correctly to enable its safe recovery or disposal without harming the environment.

Benefits of applying the waste hierarchy for wood

Prevention: Businesses and individuals can prevent wood waste by reusing wooden items (e.g. furniture, pallets, and structural timber). They may also identify ways to reduce demand for timber (e.g. lightweighting). Prevention avoids the impacts of producing and distributing these timber products.

Preparing for reuse: The benefits that can be achieved by preparing wooden products for reuse, depend on the source of the virgin wood being avoided and on the amount of refurbishment required based on time and cost to business. The potential benefits include reduced biotic resource depletion, savings in raw material use and reduced greenhouse gas (GHG) emissions.

Recycling: Clean wood waste can be recycled into a variety of end products, including panelboard, mulch or animal bedding. Contamination with paint, preservatives, chemicals or other materials (e.g. nails) reduces the range of feasible recycling applications. Where possible, to maximise the quantities of wood that are recycled and the benefits of doing so, wood should be graded according to the end markets for which it is suitable.

Other recovery: The Waste Strategy for England (2007) estimated that recovering energy from 2 million tonnes of waste wood could reduce CO₂ equivalent (CO₂e) emissions by 1.15 million tonnes, with greater benefits if heat is recovered in addition to power generation. Lower grade waste wood, in particular, is an underutilised renewable fuel resource.

Disposal: In landfill, wood breaks down and emits methane over a long time, so waste wood should be diverted from landfill.

Preparing for reuse Case Study: Pallet reuse and resale

DENSO Manufacturing UK Ltd in Telford employs more than 1,150 people and is part of the Thermal Systems Division of DENSO Corporation, one of the world's largest manufacturers of air-conditioning and cooling products for the automotive industry.

All pallets that were recycled are now sorted and reused. This has led to a 743-tonne reduction in pallet recycling, the sale of 69 tonnes of Euro pallets and a 242-tonne reduction in new pallets purchased. In the first two years, this has saved the company about £100,000.

Other recovery Case Study: Using waste wood to generate heat

Furniture manufacturer, Warren Evans, installed dust extraction and a biomass boiler in its factory. All extracted dust is fed into a silo at the factory and is then fed into the biomass boiler, which also burns the sawdust, offcuts and wood chippings from the manufacturing process to heat the factory.

The dust extraction and biomass boiler system resulted in better ventilation and removal of dust from the shop floor, and heat is now recovered from the waste wood for space heating, which reduces the company's heating and waste disposal costs.

Glass

In 2008, over 2.6 million tonnes of glass packaging were used in the UK, 61% of which was recycled. The vast majority of glass made in the UK is clear, and the rest is evenly split between amber and green. In the hospitality sector (hotels, pubs, etc), waste glass makes up between 10% and 30% of all waste produced.

In addition to glass packaging (e.g. drinks bottles), waste also arises from architectural glass (e.g. windows), automotive glass (e.g. windscreens) and from electrical equipment. Figures from British Glass suggest that, in 2006, 1.1 million tonnes of flat glass were produced in the UK. It is estimated that up to 500,000 tonnes of flat glass waste are produced from buildings each year in the UK. Of this, just under half is recycled.

Waste hierarchy options for glass

Prevention

- Use returnable bottles wherever possible or bottles that can be refilled on site (e.g. 'house water' bottles for the hospitality industry).
- Visit www.wrap.org.uk/construction/how_do_i_reduce_waste/index.html for ideas on reducing glass waste in the construction sector.
- Glass containers can also be offered on reuse websites, sold or auctioned.
- Segregate waste glass for collection, washing where applicable, and reuse (e.g. waste drinks bottles from the hospitality sector).

Preparing for reuse

We are not aware of any preparing for reuse options for waste glass.

Recycling

- Segregate and colour sort glass waste to get the best price for your recycling collection service and to maximise the potential for it to be recycled into new high value products.
- To find local recycling collection service providers, visit the [NetRegs Waste Directory](#).
- Lower value recycling options include the segregation of glass waste to be mixed with aggregate.

Disposal

- Ensure you follow your duty of care responsibilities to manage waste correctly to enable its safe recovery or disposal without harming the environment.

Benefits of applying the waste hierarchy for glass

Prevention: Minimising the amount of glass used and reusing glass have significant benefits because raw material use and energy for manufacturing are avoided. Preventing the use of 1 tonne of virgin glass, could avoid over 800kg of carbon dioxide equivalent (CO₂e) being emitted.

Preparation for reuse: The benefits associated with reusing glass (i.e. the reduced need for raw materials and energy to manufacture glass), far outweigh the environmental impacts of collecting and washing glass

ready for reuse.

Recycling: Glass can be recycled an infinite number of times. There are two main options for glass recycling.

The first is closed-loop recycling through remelt, where glass ‘cullet’ is collected for recycling and used in new glass products. This eliminates or reduces the need for virgin glass and significantly reduces the amount of energy required to make new glass products. Closed-loop recycling also reduces the environmental impacts associated with transportation as raw material extraction and transport is replaced with transport of glass ‘cullet’. This remelt may take place in the UK or abroad (mostly Spain, Italy and Portugal). Export does reduce the benefits of recycling, but it does not negate them.

The second option is open-loop recycling (e.g. through the reuse of aggregates), where glass is blended with other aggregates for various applications such as road surfacing. The environmental benefits of using glass in this manner are negligible because of the relatively low impact of the material aggregate being replaced.

To maximise the benefits of glass recycling, glass should be sorted to meet the quality requirements of the remelt application. Guidance on how to set up collection systems to deliver this can be found in [PAS101](#) , which is a specification for quality and guidance for good practice in collection of recovered container glass. The specification aims to assist glass collectors in achieving the highest grades of the PAS 101 specification by harmonising the range of existing specifications for raw container glass collected in the UK and introducing a four tier grading system.

The WRAP website also includes the guidance note ‘ [Clear steps to a cleaner collection](#) ’ and further [information on recycling different types of glass](#) . Where these quality requirements cannot be met, recycling into aggregates may be one of the only options available.

Other recovery: No energy can be recovered from waste glass. Some value may be recovered if the incinerator bottom ash can be used (e.g. in construction), but in environmental terms the benefits are negligible. Where glass is present in mixed waste destined for energy recovery, it should be removed, either by encouraging greater recycling by businesses and householders or by sorting before the energy recovery process.

Disposal: As an inert material, glass does not degrade in landfill. However, it is lost to the resource economy and takes up landfill space Therefore, every effort should be made to separate it for recycling.

Prevention Case Study: AB Inbev - Stella Artois bottle design improvements

The recycled content of glass bottles used by Stella Artois has increased to 75%. The company’s 330ml and 250ml glass bottles are the lightest lager bottles on the market, based on a pack-to-product ratio.

In April 2010, the company lightweighted its highest selling bottle - 284ml (180g) by 7%. It now weighs 167g and will save 3,250 tonnes of glass annually and reduce carbon dioxide equivalent emissions by 2,484 tonnes.

“We are very pleased with the new Stella Artois lightweight bottle. As a pioneering brand, Stella Artois cares about doing the right thing for the environment. WRAP has been an invaluable partner in determining how we can continue to take small steps towards improving our environmental performance, and we look forward to continuing to work with them in the future.” James Watson,

Marketing Director.

Recycling Case Study: Light the way to glass recycling

Glass recycling makes a major contribution to energy and material savings in the manufacture of new bottles and jars. For each glass bottle recycled, the energy saved is equivalent to that needed to power a light bulb for nearly an hour. For every tonne of recycled glass used to make new containers, 315kg of carbon dioxide is saved.

Recycling glass is now a very efficient operation offering convenience and handling benefits to commercial and business users of glass containers. It is no surprise that businesses and commercial organisations that routinely recycle glass will never go back to disposing of glass in their normal waste stream.

A large hotel in Yorkshire mixed glass containers (alcohol and food related) with the general waste arisings from the hotel. Broken glass, rubbish and waste presented hygiene and handling challenges. As soon as a regular glass recycling service was introduced for glass bottles and jars, the number of general waste skips needed was reduced. Importantly, given that the integrated glass collection system cut down on double handling, recycling glass made disposal much safer.

Metals

Industry estimates that 15 million tonnes of metal waste are produced annually in the UK. Of this, over 13 million tonnes are recovered and recycled. In 2008, 34.6% of aluminium packaging and 61.7% of steel packaging were recovered or recycled.

Most waste metal arising from households is in the form of packaging (cans for food, pet food and beverages), white goods (washing machines, refrigerators, cookers, etc) and brown goods (televisions and video players etc). Waste metal from such sources accounted for 4.3% of municipal waste in England in 2006/2007, or 1.2 million tonnes.

Waste hierarchy options for metals

Prevention

- Lean production and product lightweighting can prevent metal waste being produced.
- The second-hand market for vehicles is well established and provides a market for unwanted vehicles that are still functional.
- Businesses can reuse intermediate bulk packaging rather than sending it for disposal.

Preparation for reuse

- Opportunities are available for metals to be reused by businesses (e.g. reconditioning drums, containers, and machinery).
- The reconditioning of intermediate bulk containers (IBCs) has a well established and effective international infrastructure for ensuring the reuse over multiple cycles. This is supported in international law through regulations governing the manufacture, testing, filling, carriage and reconditioning methods for IBCs.
- The Industrial Packaging Association provides a list of businesses that manufacture and recondition bulk containers (<http://www.theipa.co.uk/download/members.pdf>).

Recycling

- The British Metals Recycling Association Provides a directory of metal recyclers.
- Collect more primary packaging metals by promoting recycling at work (advice is available from www.alupro.org.uk and www.cspr.co.uk).

Other recovery

- We are not aware of any other recovery options for waste metals.

Disposal

- Most waste metal has a value for reuse or recycling. However, where it is not possible to segregate metals for reuse or recycling, ensure you follow your duty of care responsibilities to manage waste correctly to enable its safe recovery or disposal without harming the environment.

Benefits of applying the waste hierarchy for metals

Prevention: Metals require significant quantities of energy and raw materials in their extraction and manufacture. This varies enormously for different types of metal. For example, avoiding producing 1 tonne of virgin aluminium metal could avoid over 10 tonnes of carbon dioxide equivalent (CO₂e) being emitted. It is possible to reduce the need for virgin metals by prolonging the life of products and reusing them wherever possible.

Preparation for reuse: Reusing metals avoids the environmental impacts associated with their production. Metal products may require refurbishment to make them suitable for reuse.

Recycling: The environmental benefits of recycling metals are unequivocal across a range of environmental indicators, including greenhouse gas (GHG) emissions and resource depletion.

Energy recovery: No energy can be recovered from waste metals. If they pass through the energy recovery process they can subsequently be extracted from the ash for recycling. However, every effort should be made to remove them from the recovery fraction, either by encouraging greater segregation and recycling, or by sorting before the recovery process.

Landfill: Metals may rust in landfill and break down, or may remain in situ. As there is no opportunity to recover value, landfill remains at the bottom of the waste hierarchy.

Prevention Case Study: Achieving cost savings and environmental benefits through resource efficiency

Tube Lines Escalator Services (TLES), a division of Tube Lines, manages a total of 227 escalators on the Jubilee, Northern and Piccadilly underground lines. The reliability and safety of this fleet of escalators are vital to the successful operation of the tube system as a whole. Escalator management includes a statutory inspection of the overall condition of each escalator every 6 and 12 months, planned maintenance and refurbishment.

Historically, the general scope of work performed during escalator refurbishment resulted in the replacement of components that were still in good working order. TLES introduced a pre-start inspection prior to any planned maintenance activity to determine exactly what needed to be replaced. All required items were procured and stored at the depot for delivery to the stations when needed. Now, components in good working order are no longer replaced and much less waste is produced.

Discussions with manufacturers resulted in the supplier of escalator steps taking back used steps from refurbishment projects. Previously, all such materials were recycled as scrap, but now each step is inspected to determine its potential for reuse. If the components are not too badly worn, the supplier is able to steam clean and recover them for reuse. Depending on the proportion that can be reused, the supplier reduces the bill for new steps purchased by TLES. A total of 150 tonnes per year of scrap metal is now reused or recycled.

A similar agreement has been established with suppliers to take back the wooden pallets on which escalator components are delivered. The pallets are either sent straight back or stored at the depot until they can be returned to the supplier. About 4 tonnes per year are sent back for reuse at no cost to TLES.

Recycling Case Study: Segregating and recycling metals from the oil and gas industry

Duco Ltd is part of Technip, a large engineering construction company based in France. It manufactures bespoke sub-sea control umbilical systems for oil and gas facilities.

Duco manufactures and supplies umbilicals and recovers old umbilicals that it then recycles. The recovered umbilicals are a combination of many different waste streams, some of which are very valuable. Nylon, for example, is worth as much as £600,000 a tonne, but it can be very difficult to extract. Before any materials from redundant umbilicals can be recycled, they must first be cut into manageable lengths.

Duco has had to look very carefully at its methods of cutting up the umbilicals. In the early years, it used Stihl saws, but this was very time consuming; it could take employees a few weeks to cut up 500 metres of umbilical, which is not a great deal of waste for this industry. However, Duco invested in new equipment and is now able to cut up 500 metres up in a day.

Plastics

The UK uses over 5 million tonnes of plastics each year. The major markets are for use in packaging, construction and automotive products, but plastics are also used in furniture, electrical items, toys retail displays, including clothes hangers and agricultural films.

Plastics may be derived from fossil-based oil or from plant materials (biopolymers). Biopolymers can have the same characteristics as conventional polymers or can be made in such a way that they biodegrade at the end of their life. Although there has been an increase in the use of bioplastics, it is estimated that they still account for under 5% of plastics used in packaging.

‘Oxo-degradable’ plastics are made of fossil fuel and contain additives that allow them to degrade faster than conventional plastics. They are not suitable for composting and may not be suitable for conventional recycling.

Waste hierarchy options for plastics

Prevention

- Consider design options to reduce the amount of material in products.
- Review opportunities to use returnable transit packaging (e.g. crates, sleeves) or refillable packaging, rather than single-trip packaging. Think about transport distances, the number of uses, loss rate and cleaning requirements, to make sure this does make environmental sense compared with single-use alternatives.
- Reduce the quantity of plastics in products through design improvements such as lightweighting.
- Reduce the quantity of waste plastics through more efficient procurement, materials management and manufacturing processes.

Preparation for reuse

- The reconditioning of intermediate bulk containers (IBCs) has a well established and effective international infrastructure for ensuring the reuse over multiple cycles. This is supported in international law through regulations governing the manufacture, testing, filling, carriage and reconditioning methods for IBCs.
- The Industrial Packaging Association provides a list of businesses which manufacture and recondition bulk containers (www.theipa.co.uk/download/members.pdf).

Recycling

- To maximise the environmental benefits of a recycling scheme, the system should deliver plastics with low levels of contamination to allow ready sorting of polymers.
- Consider the use of bailers to reduce the volume of plastics that need to be stored on site, the transportation costs and also the frequency of collections required.
- Uncontaminated plastics from the building and construction sector (which accounts for 23% of the plastics market) can be readily recycled.
- Contaminated plastics can be suitable for recycling after additional processing.
- Recycling facilities for PVC waste from construction and demolition can be found from

Other recovery

- Where plastics cannot be recycled (perhaps due to difficulties in segregating waste), it may be possible to send them for use in energy-recovery operations.

Disposal

- Ensure you follow your duty of care responsibilities to manage waste correctly to enable its safe recovery or disposal without harming the environment.
- If you produce loose plastic packaging such as shrink wrap, plastic ties or plastic bags, that cannot be handled by any of the options outlined above consider using a compactor or bailer to reduce the volume of waste you send to disposal, hence reducing the frequency of collections required.

Benefits of applying the waste hierarchy for plastics

Prevention: Taking into account the whole system (including collection, sorting and cleaning of plastics) prevention provides environmental benefits due to the avoidance of using raw materials and energy required to manufacture new plastics.

Preparation for reuse: Preparing plastics waste for reuse provides environmental benefits through avoided raw material and energy use in the manufacturing process

Recycling: Plastics collected for recycling are sent to a variety of markets. There is a growing domestic market for products made from recycled plastic, including closed-loop applications such as bottles. Plastics are also sent abroad for recycling; the environmental benefits of this vastly outweigh the transport impacts. Recycling plastics avoids a significant amount of raw materials and energy use and reduces greenhouse gas (GHG) emissions, even when transport is taken into account. The exact impacts depend on the material being replaced and the relative life of the alternative product. Some plastics made from bio-based materials may also be suitable for recycling, although the quantity on the market is not understood to be high enough to allow economic recycling.

Other recovery: Plastics have a high calorific value relative to other wastes, so they can generate a large amount of energy when combusted, gasified or pyrolysed. However, when plastics are made from fossil fuels (i.e. oil), the GHG emissions from recovering energy are far higher than any other waste management technique for plastics. When sent to energy recovery, bio-based plastics substitute for fossil fuels, leading to environmental benefits over landfill. Some bio-based plastics may be suitable for anaerobic digestion, but this will depend on the specific characteristics of the polymer.

Disposal: Conventional plastics will degrade very slowly, if at all, in landfill conditions. However, they are lost to the resource economy and take up landfill space. In terms of GHG emissions, sending plastics to landfill is preferable to conventional energy recovery, but is less preferable in terms of all other environmental indicators commonly considered in life-cycle assessment. Overall, disposal remains the bottom of the waste hierarchy.

Plastics that are designed to degrade may or may not break down in landfill depending on their properties and the landfill conditions. There is a lack of research into this at present, but if the materials do decompose they are likely to lead to emissions of methane. A proportion of this is captured for energy recovery, but much also escapes into the atmosphere.

Prevention Case Study: Computer controlled frame cutting reduces waste

Yorkshire Window Company Limited is a manufacturer of UPVC windows, doors and conservatories. It is a family-run business that employs over 200 people at its site near Rotherham. The company is ISO 14001 certified and is working towards EMAS certification. Implementing resource efficiency projects has enabled the company to optimise the production process to minimise waste generation and improve efficiency.

The PVC used to manufacture window frames is bought in standard 6-metre lengths, which must be cut in varying lengths at 45°. The company uses a computer-controlled system that determines the order of cutting. Wastage from each length is now around 1%, avoiding disposal costs of around £9,500/year.

Recycling Case Study: Using recycled content in plastic packaging

A WRAP project that demonstrates that recycled PET (rPET) can be successfully used in the production of new retail packaging. Product trials were carried out with Coca-Cola Enterprises, Marks and Spencer (M&S) and Boots - in conjunction with plastic recycling specialist Closed Loop London - covering sourcing, production, processing and testing, as well as consumer acceptance. The trials showed that it is perfectly possible to package food, beverages and beauty products in containers containing up to 50% of recycled material without compromising performance, storage stability or visual appeal. The ultimate measure of the project's success is that both M&S and Boots are now widely using rPET in their product lines and Coca-Cola are planning to carry out further trials using rPET. Coca-Cola trials showed that using r-PET reduced the amount of energy needed for bottle manufacture compared to virgin resin, offering a small saving in electricity costs. rPET can be more expensive if bought in small quantities, but once economies of scale arise, the cost of rPET is comparable to virgin PET. Using rPET could present a means of managing fluctuating resin costs.

Waste Electrical and Electronic Equipment (WEEE)

Environment Agency figures for 2009 show that 1.54 million tonnes of electronic and electrical equipment (EEE) were bought by householders and businesses. Of this, about 20% was purchased by businesses.

Metals are, by far, the largest component of WEEE. Plastics, metals/plastics mixtures and glass from screens are the next largest groups.

The hazardous components that can arise in some WEEE require specific waste treatment. For example, cathode ray tubes in televisions, monitors and flat panel displays require specialist treatment. These hazardous components should be removed from the WEEE and treated separately. The remainder can then be recycled through the normal channels.

Waste hierarchy options for WEEE

Prevention

- Retain and use items for longer.
- Sell or donate unwanted items.
- Purchase second-hand items.
- Lease rather than purchase electrical equipment.

Preparing for reuse

- Arrange for WEEE to be collected and refurbished and/or resold.
- There is a thriving market for reconditioned large appliances and IT equipment.

Recycling

- Segregate and arrange recycling of all WEEE.

Other recovery

- Ensure that your WEEE contractor is reputable and removes recyclable components from WEEE before sending the residual combustible waste for energy recovery.

Disposal

- Only dispose of any residual waste from WEEE that cannot be reused, recycled or recovered.
- Ensure you follow your duty of care responsibilities to manage waste correctly to enable its safe recovery or disposal without harming the environment.

Benefits of applying the waste hierarchy for WEEE

Prevention: Research to be published by WRAP shows that, for some items (e.g. mobile phones, drills, cameras, trimmers, and some small kitchen and personal care products), the impact of production is far greater than their in-use energy consumption.

The Department for Energy, Food and Rural Affairs (Defra) is working on a series of projects to encourage manufacturers to design products that last longer and can be repaired more easily. WRAP is due to publish further research that informs the debate on when it is appropriate to repair or reuse certain items rather than replace them.

Preparing for reuse: Repair and refurbishment avoid the environmental impacts of manufacturing new goods. Although 59% of office machinery and computers disposed of by businesses are reusable without repair, some may need refurbishing and/or upgrading. A WEEE reuse standard is being developed by the WEEE Advisory Body. Meanwhile, people can have WEEE they want to sell or buy tested for electrical safety through portable appliance testing (PAT). For more information and a directory of service providers, see www.pat-testing.info/. Defra is working on a series of projects to encourage manufacturers to design products that last longer and can be repaired more easily.

To maximise activities that prepare WEEE for reuse, collection methods must avoid (further) damage to the equipment. [Good practice guidance on the collection and treatment of WEEE is available from WRAP](#).

If you allow contractors access to WEEE for the purposes of refurbishment (or recycling), you must satisfy yourself that they operate legally and, in particular, that WEEE is not exported illegally outside the Organisation for Economic Co-operation and Development (OECD).

Recycling: Even when the environmental impacts of collecting and reprocessing are considered, WEEE recycling proves to be clearly advantageous from an environmental perspective compared with incineration or landfill. This is because the benefits of recycling the metallic and uncontaminated plastic fractions of WEEE outweigh the impacts of the recycling process, in terms of greenhouse gas emissions and resource depletion.

Recent demonstration work has shown a 50% to 75% reduction in emissions from using recycled WEEE plastics rather than virgin plastics. In addition, it is estimated that only 1% of 'speciality' metals (or 'rare and precious metals') used in electronics are recycled. Research by the United Nations Environment Programme suggests that microchip manufacturers use more than 60 of these metals, with demand for indium, for example, expected to double by 2020. Recycling these metals is between 2 and 10 times more energy efficient than smelting the metals from virgin ores (which are also to be found in very few places on Earth).

Other recovery: Once the metal fraction, printed circuit boards and high-quality plastic fractions have been taken out for recycling, incineration with energy recovery is preferable for the residual combustible waste from WEEE. Any hazard associated with the material will require consideration before sending this material for further recovery.

The hazardous components of WEEE call for specific waste treatment and are not covered in this guidance. They will be covered in the guidance that will follow the Strategy for Hazardous Waste Management in England.

Disposal: Landfill is the waste management method of last resort for WEEE and should be avoided.

Prevention Case Study: Reducing cost and improving functionality at Varian Medical Systems UK Ltd

Varian Medical Systems opted for the sustainable redesign of its radiotherapy simulator collimator unit and

is now achieving £162,000/year in components and materials cost savings, a 65% reduction in the number of components used per collimator, a reduction of 29% in the number of fasteners and a 27% reduction in assembly time, and easier equipment disassembly for recovery and recycling.

“The sustainable product design approach has proved to be a real eye-opener, taking away preconceptions and resulting in products with significant cost savings and better functionality.” John Peel, Business Development Director, Varian Medical Systems UK Ltd.

Recycling Case Study: Motorola mobile phone

The Moto W233 Renew handset is made from recycled plastic water bottles. The opportunities for using recycled plastic to manufacture new electrical products has been realised in this handset, which has been designed for hand disassembly (the battery, casing, mother board and display can be separated in 10 seconds).

Product facts: casing made from 25% recycled plastic (polycarbonate from 5-gallon water bottles used in businesses), casing 100% recyclable (can be recycled), uses 20% less energy to manufacture compared with using virgin plastic, lightweight (average phone weighs 130g), packaging size reduced by 22%, box and print uses 100% recycled materials, designed for disassembly.

Food

Of the estimated 18 to 20 million tonnes of food waste created in the UK each year, around 8.3 million tonnes comes from households and a further 5 million tonnes is lost in the supply chain. The majority of this is still sent to landfill, where it breaks down and releases methane which has a global warming potential **21 times** that of CO₂.

Waste hierarchy options for food

Prevention

- 'Love Food Hate Waste' is a UK-wide campaign that provides information and advice on how to reduce food waste through its website, media campaigning and events. Businesses can partner with this campaign. For further information, visit www.wrap.org.uk/love_food_hate_waste/partners.
- Consider donating unwanted good-quality edible food, that would otherwise be wasted, to organisations such as FareShare, which distribute surplus 'fit-for-purpose' product from the food and drink industry to organisations working with disadvantaged people. For further information visit www.fareshare.org.uk

Preparing for reuse

We are not currently aware of any economically viable options for preparing food waste for reuse.

Other recovery

- Businesses that are considering using or investing in anaerobic digestion can find advice at www.biogas-info.co.uk. The option of anaerobic digestion should be considered before other recycling and recovery options for food waste.
- Food waste can be used in energy-from-waste plant, which reduces the need for fossil-fuel-generated energy.
- Edible foods that go to rendering plants for authorised uses, such as the manufacture of pet food, is also a form of recovery.
- Waste oils from restaurants and catering facilities can be turned into biofuels.

Recycling

- Where food waste is contaminated with packaging, it is, in some cases, possible to use depackaging equipment to segregate the waste, which enables segregation for recycling. WRAP's [Review of Food Waste Depackaging Equipment](#) report provides further information on the equipment available.
- Businesses that are considering sending food waste for composting (or anaerobic digestion) can find basic information and further pointers on [Business Link](#).

Disposal

- Ensure you follow your duty-of-care responsibilities to manage waste correctly to enable its safe recovery or disposal without harming the environment.

Please note that food waste must be treated in accordance with the relevant legislation.

Visit www.netregs.gov.uk to find out more.

Benefits of applying the waste hierarchy for food

Prevention: Wasting food, wastes the resources that have gone into growing, processing and transporting that food. On average, preventing 1 tonne of food waste avoids over 4 tonnes CO₂ equivalent. Preventing food waste saves far more than any of the options for managing this waste.

Preparing for reuse: We are not aware of any preparing for reuse options for waste food.

Other recovery: Options for treating food waste include, in order of environmental benefit, anaerobic digestion, composting (in-vessel or home/local composting) and incineration with energy recovery. In this case, a recovery option (Anaerobic digestion) is better in environmental terms than a recycling option (composting). This is a departure from the normal order of the waste hierarchy shown previously in Figure 1.

During anaerobic digestion, food waste is microbiologically broken down in enclosed containers in the near absence of oxygen. The outputs produced are:

- **digestate** - which can be used instead of fertilisers that are produced using fossil fuels; and
- **gas** - which can be used for vehicle fuel, heating, electricity generation, fuel for combined heat and power plant or refined and directly injected into the gas grid.

The combination of both outputs means that anaerobic digestion is environmentally preferable to composting and is the best available treatment option for food waste.

Recycling: In addition to commercial composting, small to medium-scale composting may be carried out by voluntary, community and environmental organisations, and social enterprises, which collect and compost food and garden waste from local houses and businesses. The Community Composting Network is the overarching body for voluntary, non-governmental organisation and community composters (www.communitycompost.org).

In-vessel composting (IVC) is the only type of composting that is legal for commercial food waste that has come into contact with animal products. Where businesses process vegetables only or where they have, for example, a dedicated vegetable processing line with a strict Hazard Analysis Critical Control Point (HACCP) agreed with the local authority to guarantee complete separation from all products of animal origin, can this food waste be composted in the open air.

Other recovery: Food waste is combustible and, as a renewable material, it can replace the burning of fossil fuels when energy is recovered. Even in incineration facilities where only electricity (and not heat) is produced, combustion offers some environmental benefit.

Segregated and non-segregated food waste may also be a suitable feedstock for the production of renewable transport biofuels, renewable heat power and/or renewable chemicals through advanced biofuels and biorefinery technologies. These can often provide greenhouse gas savings and reduce demand for resources.

Rendering is a treatment process through which food waste and other animal by-products are 'cooked' at high temperature, sometimes under pressure, to remove moisture and until the fat (tallow) can be separated from the protein material. Tallow can be used to produce tyres and paint, fertilisers, fuel and small amounts may also be used in feedstuffs. The protein element can be dried to produce meat and bone meal that can be

used, subject to animal by-product controls, as a protein source in pet food manufacture and as a fuel.

Landspreading of catering food waste is another recovery option, but there is no evidence of its environmental benefits relative to other waste management methods. Please note that food waste must be treated in accordance with the relevant legislation. Landspreading of food waste is subject to the controls regulated by the Environment Agency, and to the requirements of Environmental Permits or exemptions see www.defra.gov.uk/environment/quality/permitting

Disposal: Food waste should be diverted from landfill wherever possible because it degrades over a short period of time in landfill, which gives rise to methane emissions. Even where methane is captured for flaring or energy recovery, the overall impact is still negative.

Prevention Case Study: We'll get less waste pasty (past-he)!

Ginsters is a long-established company, famous for its Cornish pasties, which it has been making for over 40 years. The bakery forms the heart of the business, where about 3.5 million products a week are manufactured.

One initiative that the company implemented to prevent waste was the standardisation of the shapes of products and the raw materials used, for example Ginsters is no longer making different varieties of pastry.

"We reuse the scrap pastry generated through the manufacture of our products in the pastry production for other products. If we have too much variation in the different types of pastry manufacture, we wouldn't be able to reuse that material, it would have to be thrown away. So, by standardising our manufacturing practice, it means that there's a lot more scope for potential reuse of raw materials, which would normally just be thrown away". Mark Bartlett, Environmental Manager, Ginsters.

Recycling Case Study: Salad supplier puts food waste to good use

Sussex-based Natures Way Foods, a member of the Langmead Group, supplies washed and ready-to-eat salad and salad meals to supermarkets and companies in the food service sector. The company carried out a waste review, invested in technology and improved working practices to minimise waste. In the preparation hall, the outer leaves and core of the lettuces are removed and the inner leaves separated. The product then passes to the processing hall where it is washed, dried and put into plastic bags. The salad bags are then sealed and packaged for dispatch.

All green waste from the production process is collected for off-site composting. Although there is a charge for this service (£25,600 in 2005), it is considerably cheaper than disposal to landfill (estimated at £69,600/year) giving an annual saving of £44,000/year. The composted product is used as a soil conditioner on land owned by Langmead Farms and is considered suitable for organic farming. Annual applications have improved water retention, resulting in an improved weight per head of lettuce. Any leftover conditioner is used on wheat stubble for subsequent crops of lettuce.

Part 3 Key Sources of Further Support

This guide has provided you with a summary of:

- the waste hierarchy;
- why you should follow the waste hierarchy; and
- some examples to help you follow the waste hierarchy.

There is a broad range of organisations that are able to provide further support and/or information.

- The Environment Agency **WRATE** tool is a piece of software that allows businesses and public bodies to calculate the environmental impacts of their systems, including waste management impacts.
- The Environment Agency **Resource Efficiency Appraisal Development (READ)** tools will help you to benchmark how well your business is managing resources such as materials, waste and packaging, and identify the biggest opportunities to improve.
- The '**duty of care**' **code of practice**, which is a statutory document, explains how all holders, producers, carriers, importers, brokers, dealers and processors of waste can meet the legal duty set out in Environmental Act 1990, section 34 to manage that waste correctly to enable its safe recovery or disposal without harming the environment.
- The Government-funded [Manufacturing Advisory Service \(MAS\)](#) can help manufacturers to enhance their business by improving and streamlining processes to reduce waste, and becoming more energy efficient. Free initial services and grants are available.
- On the WRAP website you will find a range of tools designed to help you identify cost saving opportunities. Click [here](#) to find out more.

The key sources of support for the different levels of the waste hierarchy are listed below.

Prevention

- A simple summary of the benefits for all businesses of sustainable waste management, starting with waste prevention, can be found on the **Business Link** website.
- WRAP's **Industrial Symbiosis Programme** (previously provided through NISP) aims to help businesses become more resource efficient by bringing together traditionally separate industries and organisations from all business sectors to foster physical exchange of materials, energy, water and/or by-products together with the shared use of assets, logistics and expertise. Membership of the programme is free. It has a network of 12 regional teams across England, Scotland, Wales and Northern Ireland. Further details can be found at www.nisp.org.uk .
- Some products are subject to legal eco-design requirements. For example, packaging must be designed to minimise its weight and volume, make sure it can be recovered and contain minimum levels of hazardous substances. More details about these essential requirements can be found at www.netregs.gov.uk/netregs/63268.aspx . This includes links to relevant BSI standards.

Preparing for reuse

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- The **Construction Waste Platform** provides practical services and support to the construction industry to become more resource efficient. More information is available at www.crwplatform.co.uk/conwaste and www.wrap.org.uk/construction
 - WRAP's **Programme for Reuse and Remanufacturing** is an online resource aimed at organisations and businesses interested in the reuse and remanufacture of products. Further information is available at www.remanufacturing.org.uk

Recycling

- WRAP (www.wrap.org.uk) has a wealth of information and advice on recycling, for public sector organisations, businesses in various sectors and the general public.
- The [NetRegs Waste Directory](#) offers a search engine that allows businesses to find out where they can recycle different types of waste.

Other recovery

- Information on anaerobic digestion can be found on the [biogas portal](#) .
- [The European Recovered Fuel Organisation's web pages](#) . gives details of technologies and quality standards.
- Local authorities and private investors can benefit from financial incentives aiming to increase the supply of renewable energy. Different energy from waste technologies are eligible for varying degrees of [Renewables Obligation Certificates](#) and [Renewable Transport Fuel Certificates \(RTFCs\)](#) . The Government also plans to introduce [Renewable Heat Incentives](#) . This will allow generators of renewable heat to claim financial support for that heat.
- The NetRegs website provides guidance for on [waste management licensing legislation](#) for businesses interested in undertaking a waste activity such as composting and anaerobic digestion.

Disposal

- The [Environment Agency](#) can provide guidance on satisfying your [duty of care](#) when disposing of waste.
- If you send waste to landfill, read guidance on [treating waste for landfill](#) on the NetRegs website. If you want to find where to dispose of (or recycle) waste use the [NetRegs Waste Directory](#) to find licensed recycling and waste disposal sites in your area.

Part 4: About WRAP

WRAP - Waste & Resources Action Programme

Our Vision: A world without waste, where resources are used sustainably.

Our Mission: To help businesses and individuals reap the benefits of reducing waste, developing sustainable products and using resources in an efficient way.

Resource Efficiency



Using natural resources in the most effective way, as many times as possible, while minimising the impact of their use on the environment.

WRAP's role

WRAP's role is to help and support businesses and individuals to reap the benefits of reducing waste and using resources in a more efficient way. We have two priorities:

1. to help the UK Governments to meet their national and international commitments and build the green economy; and
2. to support resource efficiency in the UK so that householders, businesses and the public sector save money and make better use of resources.

WRAP's added value

WRAP's added value comes from our unique technical and market expertise and our ability to bring business, the community sector and individuals together. We are problem solvers and trouble shooters. If this capability existed elsewhere, we would be happy to leave it to others. But it doesn't.

What have we helped to achieve?

WRAP has been instrumental in:

- helping the UK recycling and reprocessing sector to quadruple in size between 2000 and 2008;
- diverting 670,000 tonnes of food from landfill, saving consumers over £600 million a year;

-
- stopping the growth in household packaging waste; and
 - developing a world-first technology for the closed-loop recycling of plastic bottles, which has led to the creation of a new market for recycled plastics in the UK.

Since our creation, 10 years ago, we have funded projects that will, over their lifetimes, deliver:

- over 120 million tonnes of waste diverted from landfill; and
- over 20 million tonnes of CO2 equivalent greenhouse gases saved.

Value for money

We deliver value for money through:

- minimising the cost to business of meeting Government targets;
- leveraging private sector finance to address market failures;
- creating efficiencies and economies of scale; and
- accelerating the growth of key sectors of the ‘green’ economy.

The future

The important job that still lies ahead for WRAP is to support the move towards a zero waste economy, by:

- helping others to prevent waste and to reuse products more frequently;
- helping businesses (particularly SMEs) to recycle more through responsibility deals; and
- driving greater recovery of renewable energy from waste through anaerobic digestion.

WRAP exists to address market failures. We only intervene where the free market is not delivering our funders’ policy agendas on its own. Once the market failure has been addressed, we seek to exit, leaving the market to operate freely.

WRAP Resource Efficiency Helpline 0808 100 2040

WRAP Website www.wrap.org.uk

If you have any feedback on the contents of this report, please submit it via [the WRAP website contact page](#).

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