RECYCLING OUR MINERALS

What is recycling?

Recycling is the collection and separation of materials that have reached the end of their useful life, and their subsequent reprocessing to create useable products. The term covers a wide range of processes such as the crushing and screening of construction and demolition wastes, remelting and refining of metals and the recovery and return to use after cleaning and re-assembly of articles such as mechanical or electrical components. Recycling is a key element of the government's hierarchy of waste management options that also includes the minimisation of waste and simple reuse of products.

BGS©NERC

Waste reduction → *Reuse* → *Recycling* → *Disposal*

Increasing desirability ←

BGS©NERC

Why is recycling important?

Recycling and reuse helps to protect the environment and ensures sustainable use of resources through:

- Energy conservation
- Waste minimisation
- Resource conservation

For example, in the case of metals, the energy needed to remelt scrap metal is a fraction of that required to extract the metal from its ore. For construction minerals, the benefits are obvious when the use of recycled demolition waste (broken concrete etc.) reduces the need to provide crushed rock or gravel from quarries that may be in environmentally sensitive areas. A further environmental benefit lies in the fact that if more material is recycled rather than disposed of, there is less pressure for space in landfill sites. Resource conservation is also an important benefit of recycling even though there is no prospect of most parts of the world running out of them in the foreseeable future.

BGS©NERC

Courtesy of Lafarge Aggregates Ltd

Recycling of construction minerals

Non-metallic minerals used in construction are rarely recycled as minerals. Construction minerals are normally recovered and recycled in the form of manufactured materials such as concrete, brick, plasterboard and ceramic articles. The continual demand for construction minerals, such as sand and gravel and crushed rock, for commercial buildings, roads and houses, and the consequent expansion of quarries to supply them, has been a powerful incentive to try to replace these minerals by recycled materials. These are derived from both construction waste, for example damaged bricks, and demolition waste, such as broken concrete, brickwork and masonry. An important contribution to supply is also made by secondary materials; these are materials that are waste products from industrial processes such as blast-furnace slag, which is used as aggregate and a cement additive.

©FreeFoto.com

England and Wales: sources of aggregate 2001 (million tonnes)

Primary materials:		*%*
Sand and gravel	80.0	
Crushed rock	112.9	
Sub-total	192.9	*78.3*
Recycled materials:		
Construction and demolition waste	38.0	
Spent railway ballast	1.2	
Asphalt planings	5.0	
Sub-total	44.4	*17.9*
Secondary materials:		
Power station ash	2.6	
Iron and steelworks slag	2.3	
China clay waste	2.3	
Colliery spoil	0.8	
Slate waste	0.6	
Others	0.8	
Sub-total	9.4	*3.8*
Grand total	**246.5**	

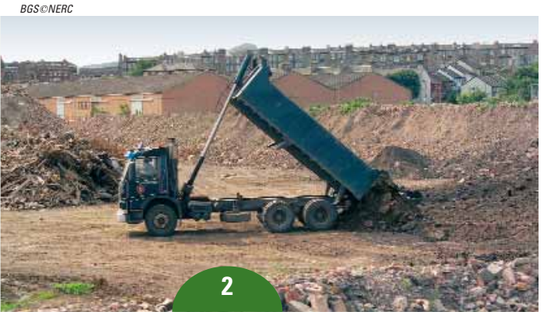
Based on data from the Office for National Statistics and ODPM surveys on construction and demolition waste and secondary materials.

In the UK, an Aggregates Levy has been imposed on the producers of primary aggregates with the object of encouraging the increased use of recycled materials. In addition, taxation of material discarded to landfill sites also encourages a reduction in waste and increased recycling. Equally, mineral waste produced, for example, from china clay and slate working, is increasingly being used as aggrgegate.

Recycling of industrial minerals

In the cases of many minerals used in industrial and manufacturing processes their valuable physical properties are either destroyed in use (for example plasticity of ceramic clays is lost during firing), or the minerals are dispersed and not readily recoverable in their original form. They may however be recovered and used in their manufactured form for other purposes, for example ceramic materials such as refractory bricks can be re-used as construction fill. Glass is a unique case among manufactured products based on industrial minerals in that, like metals, it may simply be melted and reformed with savings in energy and raw material. It may also be used in broken form ('cullet') as a road-surfacing aggregate. Minerals that are valued for their chemical properties alone are generally either difficult or impossible to recycle; examples are the salt used to treat roads and the potassium and phosphorus minerals that are the basis of agricultural fertilisers.

BGS©NERC



Courtesy of Lafarge Aggregates Ltd

BGS©NERC

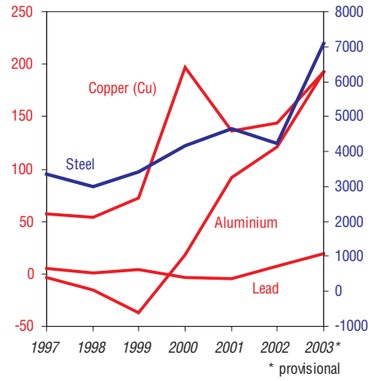
Recycling of metals

Many metals, including iron and steel, copper, tin, lead and aluminium are simple to recycle since they can be melted and re-cast or formed in other ways. In the metals industry the term 'recycling' is commonly used to include two fundamentally different kinds of scrap:

New scrap or *process scrap:* the material generated during processing and manufacturing, such as off-cuts, stampings, turnings and dust. Its recovery minimises waste in the production and manufacturing process.

Old scrap or *obsolete scrap*: the material recovered after being built into a construction or a manufactured article that has been used and eventually discarded. It is also known as '*post-consumer scrap*', or '*end-of-life scrap*'.

UK: net exports of metal scrap (thousand tonnes)



Source: UK Minerals Yearbook, BGS

UK recycling of metal scrap, 2001

	Total scrap used as % of total consumption	Old scrap used as % of total consumption
Copper	37	5[1]
Aluminium	38[2]	25
Lead	64	55
Zinc	16[3]	10[3]
Steel	37	30

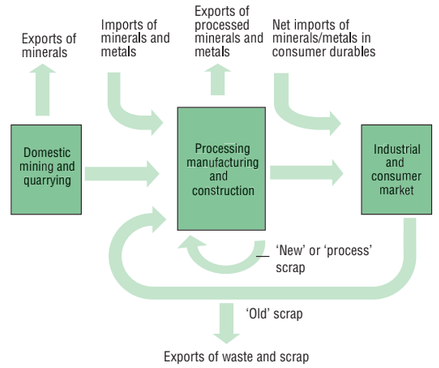
1 There is no secondary (old scrap) copper smelter in the UK
2 Secondary aluminium
3 Total remelted zinc scrap + zinc and brass alloys

Sources: World Bureau of Metal Statistics; UK Steel; DEFRA; Aluminium Federation.

Both kinds of scrap recycling minimise waste and contribute to economic activity but only old scrap actually contributes substantially to the net supply of material. In the case of lead it contributes more than 50 per cent of UK consumption. In recent years an increasing tonnage of metal scrap has been exported causing a decline in UK consumption of recycled metals.

Life cycles of manufactured articles

In a growing economy there is a limit to the extent to which waste and scrap can contribute to materials supply. The quantity of material recovered reflects the quantity originally used. Thus if the article that incorporated the material has a life-in-use of 30 years, then even if all of it were recovered after that time (which is unlikely) the amount involved would be significantly less than that needed to meet the increased demand 30 years on. If, on the other hand, the manufactured article in question has a short useful life and if material recovery can be maximised by, for example, increasing consumer environmental responsibility, then the amounts recycled have the potential to satisfy most of the demand for that material. Aluminium drink cans and lead-acid car batteries are examples of products with short life-in-use cycles.



□ Economic considerations

The cost of recovering materials from discarded products and demolition is the major factor that limits the amount recovered. The chief costs are the energy and labour costs of collection, separation and identification, each of which has an environmental impact. The recovery of, for example, certain minor metals from complex manufactured articles such as a computer may involve careful dismantling of the article concerned and the costs of doing so may well exceed those of the production cost of virgin materials. Thus while it may be environmentally desirable not to dispose of the materials in a landfill site or incinerator there may be a powerful economic case for doing so. The balance may be altered by designing products specifically for recycling, or by economic instruments from government such as the Landfill Tax and Aggregates Levy.

BGS©NERC

□ The future

Recycling will undoubtedly increase in importance as energy use is restrained by pollution concerns and as waste disposal becomes more problematic. There will, no doubt, be much greater emphasis in the future on designing products for recycling. However, it will be necessary to identify suitable sites for processing and storage of recycled materials if their contribution is to be maximised.

For further information on 'Minerals Matters' in Britain contact:

The Manager
ODPM-BGS Joint Minerals Programme
British Geological Survey
Keyworth, Nottingham, NG12 5GG
Tel: 0115 936 3494
Fax: 0115 936 3520
Email: minerals@bgs.ac.uk
Web: www.mineralsuk.com

Minerals and Waste Planning Division
Office of the Deputy Prime Minister
Zone 4/A2 Eland House
Bressenden Place, London SW1E 4DU
Tel: 020 7944 3852
Fax: 020 7944 3859
Email: mineralswaste@odpm.gsi.gov.uk
Web: www.odpm.gov.uk

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Office of the Deputy Prime Minister
Creating sustainable communities

Printed on elemental chlorine-free paper manufactured from woodpulp sourced from sustainable forests. Suitable for archival storage.