BASEL CONVENTION

UNEP

GRID ARENDAL

Vital Waste Graphics 2

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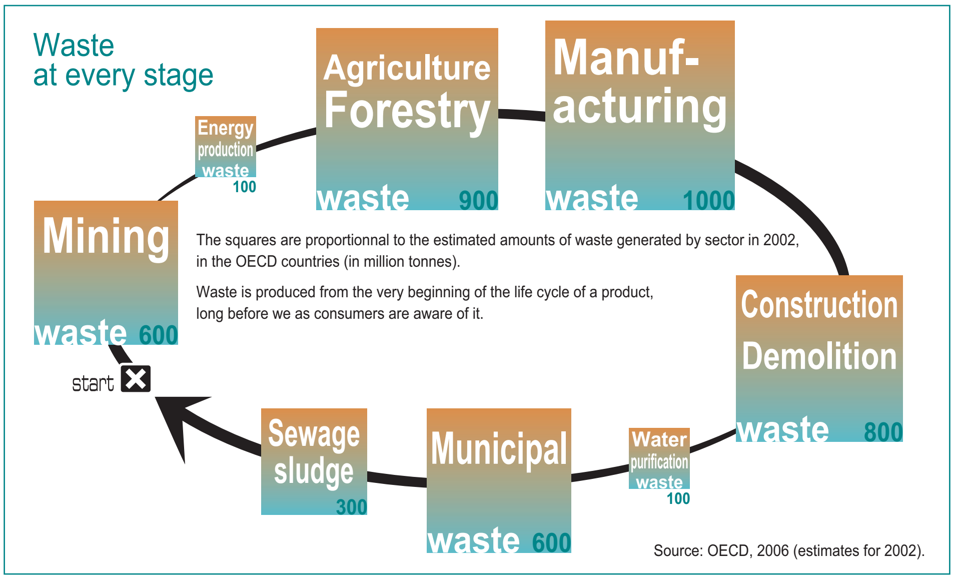
VITAL WASTE GRAPHICS 2



Source: OECD, 2006 (estimates for 2002).

DATA WARNING
HANDLE WITH CARE!

Waste is a complex and sometimes controversial issue. Good business for some, a bothersome problem for others and a threat to health for yet another category of people. Obtaining reliable data on waste is a difficult undertaking. Definitions vary across countries, so does reporting discipline. Despite efforts by international organisations to facilitate comparison by providing standardised questionnaires for reporting waste quantities, caution is required when singling out possible “culprits”. Perhaps they were just more diligent in their reporting? Numbers are also a way to fight for a political cause, and can always be read in different ways.

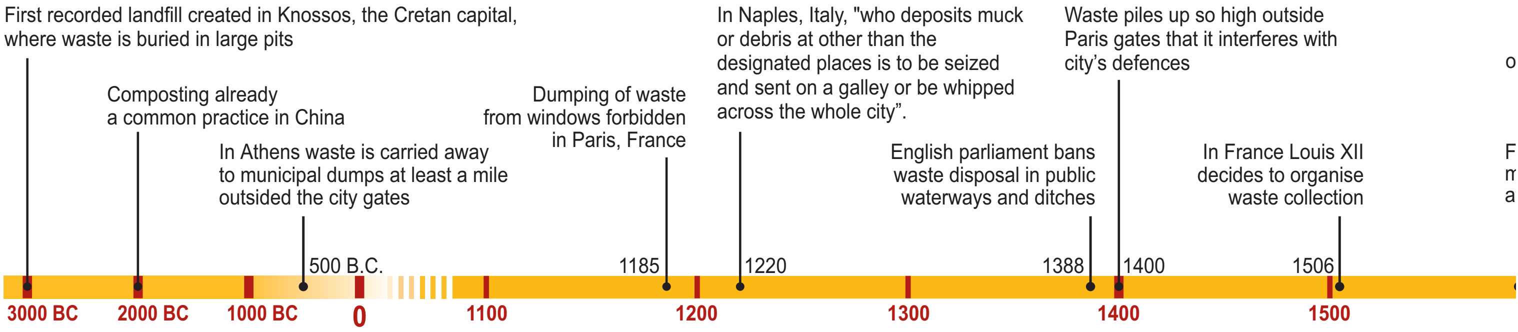
For Vital Waste Graphics we use data from various sources: NGOs, international organisations, the official Basel Convention database, specialised publications and scientific research.

Data on several waste types is subject to estimation. Expert opinions differ considerably when it comes to the estimation of total amount of a specific waste type and its share of total waste. This might result in potentially contradictory statements even within this publication.

Realising the controversy the choice of a certain dataset may cause, we ask our readers to bear in mind the above and display understanding. The aim is to describe phenomena and pinpoint trends, not to accuse individuals or countries.

As data collection systems, definitions and reporting discipline improve over time, so too will the quality and usefulness of our publication, and thus the quality of the debate it informs. In the meantime, we hope you will enjoy this work, join in debate and think about how you can contribute to rising to the global waste challenge.

A history of waste management in selected anecdotes



Sources: US Environmental Protection Agency; National Energy Education Development Project, Museum of Solid Waste, 2006; Ecollect, 2006; Waste online, 2006; Environment Switzerland 2000; Stadtreiningung Hamburg.

Dear readers,

Welcome to the second edition of *Vital Waste Graphics*. Building on the popularity of the first edition in 2004, the Secretariat of the Basel Convention on the Control of Transboundary Movements of Wastes and their Disposal has produced this edition in partnership with UNEP-GRID/Arendal with financial support from UNEP's Division of Environmental Law and Conventions (UNEP/DELC).

In this edition we have summarised key issues and highlighted global trends in waste with accessible graphics, maps and texts both within and beyond the scope of the Basel Convention.

Our prime aim is to raise public awareness of the need for environmentally sound waste management. But we must to go further. We are now addressing readers as producers and consumers of goods and the document consequently hinges on waste-related issues such as production, distribution, consumption and disposal. Collectively we must reduce waste output at every stage of a product's life, manage waste more effectively and spare natural resources. The more information we have on problems and solutions, the more we can achieve.

Individual consumers can do a great deal to cut waste output. But we need to rethink the way we consume too.

Before a product reaches its point of sale, it has already caused several times its own weight in waste. In rich countries for every rubbish bag put out by households 70 times more waste is produced in mining, logging, farming, oil and gas exploration, and industrial processes used to convert raw materials into finished products and packaging.

Economic growth does not necessarily mean more waste. There are alternatives. Producers and consumers can work on environmentally sound production methods, sustainable management of natural resources and new ways of replacing toxic components in products. We can all contribute to integrated management of product life-cycles.

Vital Waste Graphics 2 will be launched at the eighth meeting of the Conference of the Parties of the Basel Convention. The meeting is focusing on electronic waste, currently the fastest growing waste stream. In 1998 six million tonnes of e-waste was produced. Today, e-waste accounts for 8 per cent of the municipal waste stream. The volume of e-waste is expected to increase by 3 to 5 per cent a year, nearly three times faster than the overall rate. Accordingly several sections of the publication focus on mobile-phone production, use and disposal.

Readers will also find the latest data from the Basel Convention Secretariat, related organisations, and research carried out specially for the document, backed by links to additional sources.

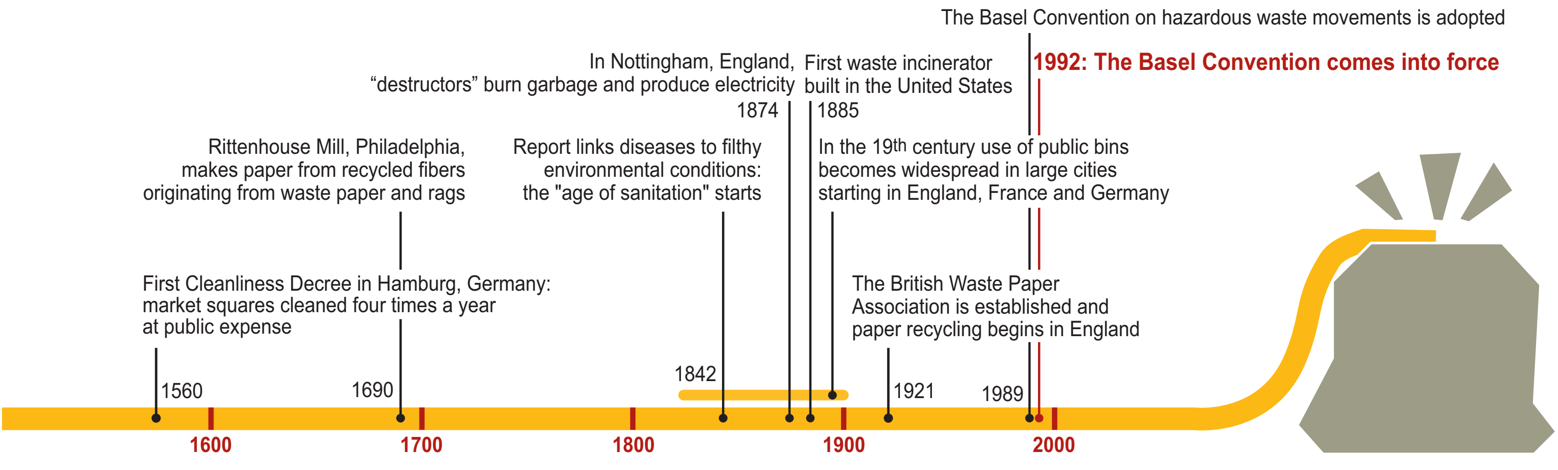
With more efficient manufacturing and consumer processes, we can reduce pressure on essential resources, improve public health and protect the environment.

Gathering waste-related data is a major challenge. I wish to extend my heartfelt thanks to all the experts involved in this project for their valuable contribution to the publication.

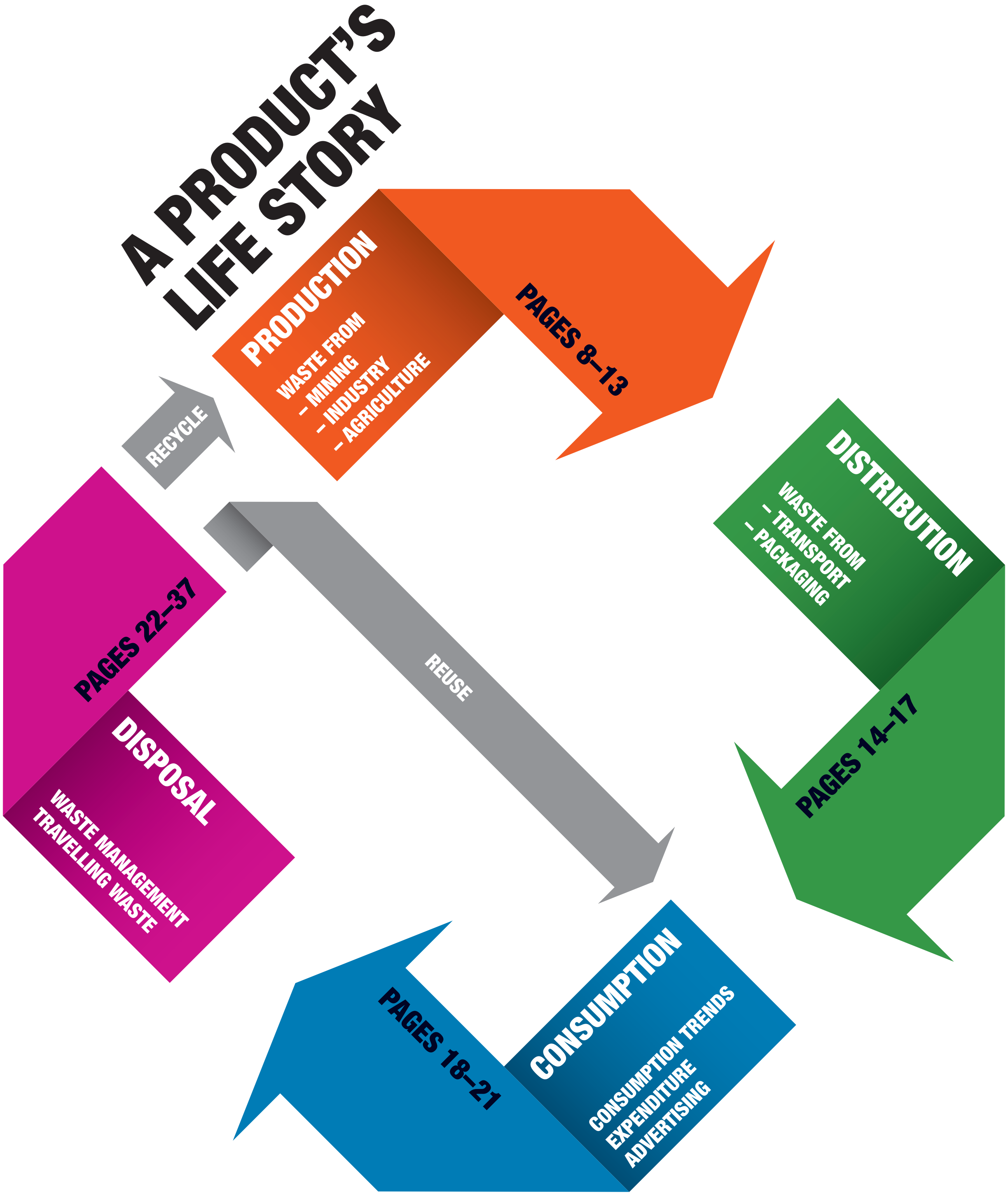
I hope you enjoy Vital Waste Graphics 2.

Geneva, November 2006

Sachiko Kuwabara-Yamamoto,
Executive Secretary
Basel Convention

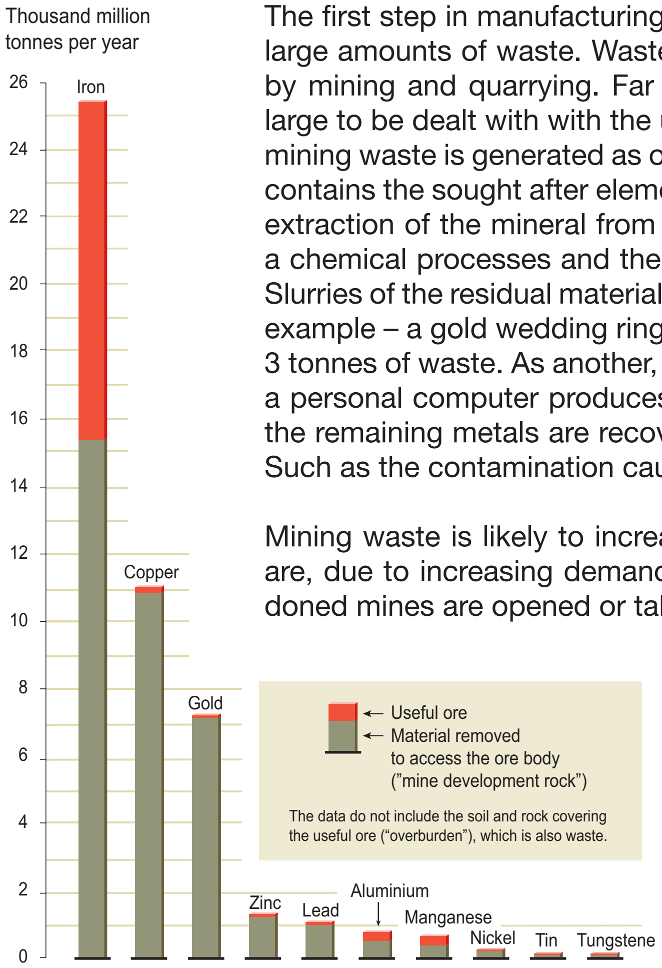


Hamburg.


A PRODUCT'S
LIFE STORY
PRODUCTION
WASTE FROM
– MINING
– INDUSTRY
– AGRICULTURE
PAGES 8–13
DISTRIBUTION
WASTE FROM
– TRANSPORT
– PACKAGING
PAGES 14–17
CONSUMPTION
CONSUMPTION TRENDS
EXPENDITURE
ADVERTISING
PAGES 18–21
DISPOSAL
WASTE MANAGEMENT
TRAVELLING WASTE
PAGES 22–37
RECYCLE
REUSE

Contents

Mountains of altered rock, lakes of gleaming liquids



Source: Worldwatch Institute, 1997 (figures for 1995).

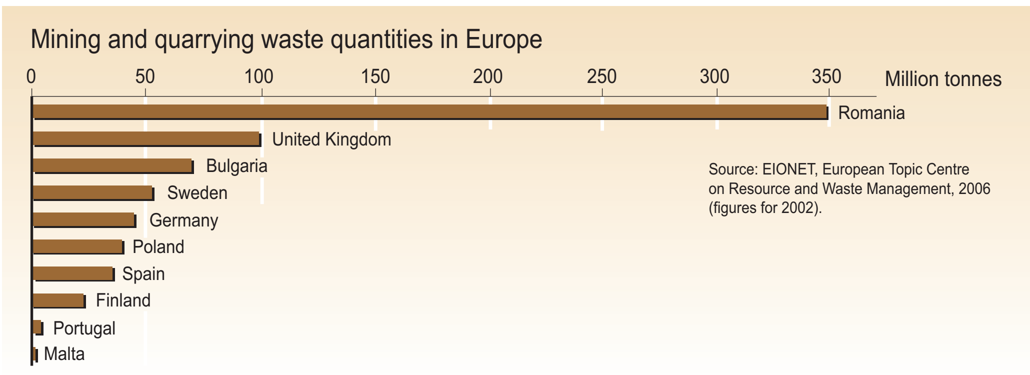
The first step in manufacturing any product – mining raw materials – produces large amounts of waste. Waste statistics do not usually include waste caused by mining and quarrying. Far from being negligible the volume is simply too large to be dealt with with the usual waste management instruments. So much mining waste is generated as only a proportion of the material removed actually contains the sought after element – and then often in small concentrations. The extraction of the mineral from this material then requires both physical and/or a chemical processes and then again leaves residues in significant quantities. Slurries of the residual material (tailings) are channelled into tailing ponds. As an example – a gold wedding ring containing five grams of gold would often leave 3 tonnes of waste. As another, the extraction of the various metals contained in a personal computer produces a total of 1.5 tonnes of waste. In many places the remaining metals are recovered and reused. However, there are problems. Such as the contamination caused by mixing them.

Mining waste is likely to increase in the future as prices for natural resources are, due to increasing demand, on the rise, and new and or previously abandoned mines are opened or taken into opreation again.

Mining waste takes up a great deal of space, blights the landscape and often affects local habitats. By its very nature it can constitute a serious safety hazard. Poor management may allow acidic and metals containing drainage to the environmnent, it can result in contaminated dusts be spread by the wind, and can also pose a physical risk. Indeed, the failure of structures such as dams built to contain mining waste has lead to many accidental spills with extremely serious consequences.

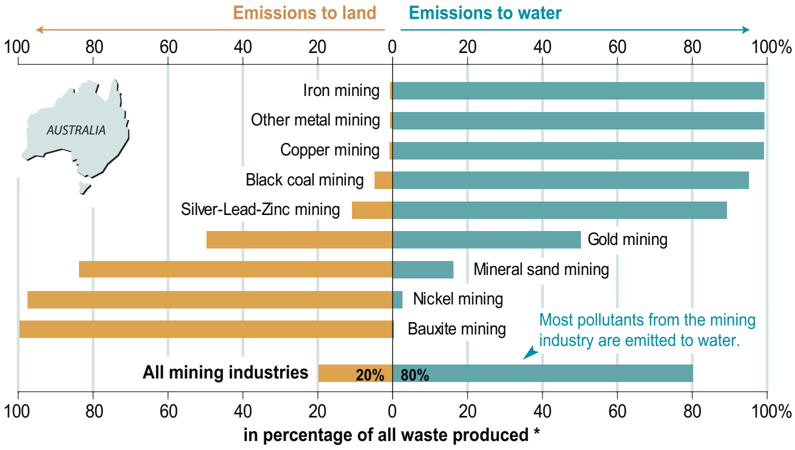
Densely packed technology and a global problem

In 20 years mobile phones have shrunk from 5 kilograms to less than 100 grams. We can use them to make phone calls of course, but also to take snaps, watch films and generally entertain ourselves, quite forgetting their ecological footprint. Many precious metals (cadmium, mercury, tungsten, etc.) are used in various parts of the device. One of the most damaging is tantalum (obtained from coltan ore). It is found in Australia, Canada and Brazil, but also the Democratic Republic of Congo (RDC). To mine coltan ore militia groups have driven local people from their land then forced them to work in the mines. Furthermore the mines are located in nature reserves home to some of Africa's last surviving great apes. Coltan, which sometimes fetches more than US$500 per kilogram thus finances local militia groups and armies. In 2001 and 2002 the UN condemned such industrial practices and proposed an embargo on Congolese coltan, but to no effect.



At 29 per cent of total wastes generated and with over 400 million tonnes of materials, mining and quarrying account for the largest stream of waste generated by countries that are members of the European Environment Agency.

Mining waste emissions to land and water in Australia



* Emissions to air are not taken into account (they are not considered as "waste" per se).
Source: Australian National Pollutant Inventory, 2006 (figures for 2004).

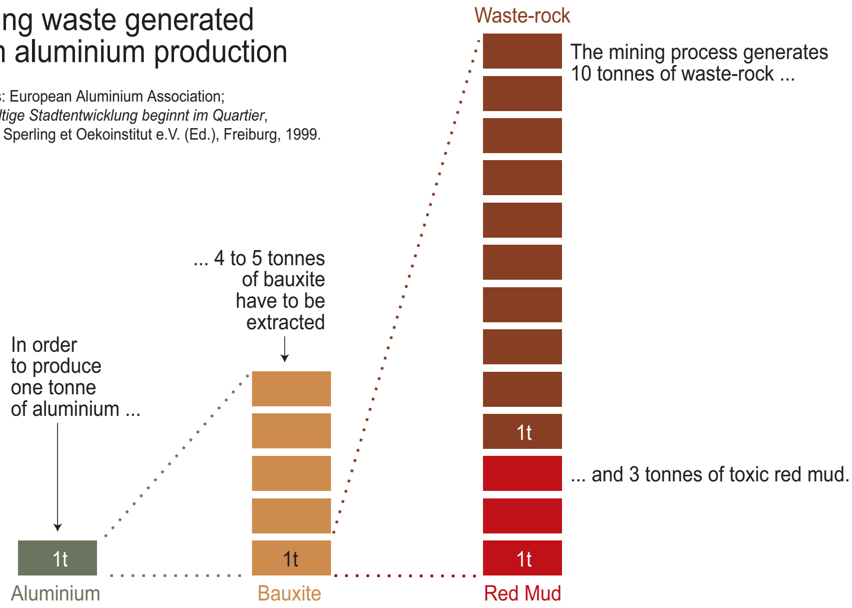
PRTRs (Pollutant Release and Transfer Registers) are databases of chemical releases to air, land and water from factories or other sources. Targeting a broad public audience, they support our right to information on toxic waste and air pollution. The Australian National Pollutant Inventory (NPI), for instance, not only provides the public with free access to data on its website but also helps facilities estimate and report emissions.

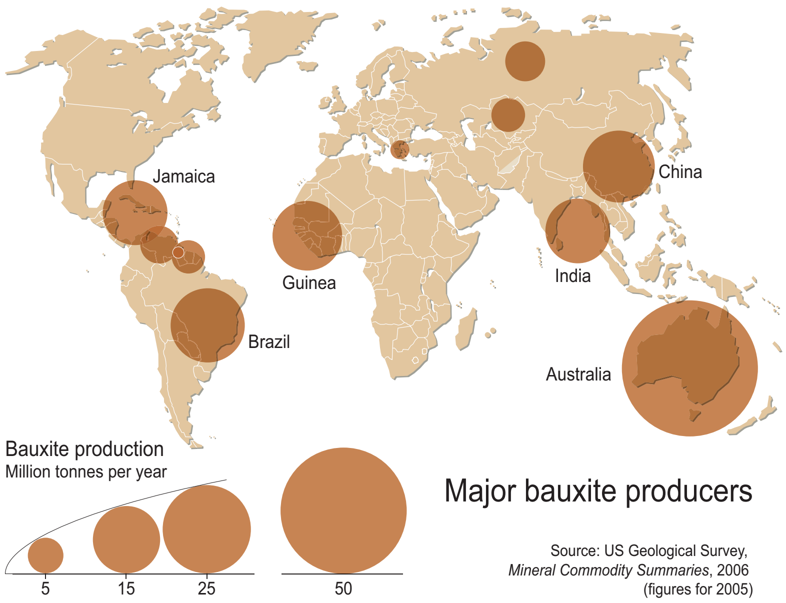
The production of aluminium involves three main stages: mining bauxite ore, refining bauxite to alumina (Al2O3), and then smelting alumina to produce aluminium. Bauxite comes from open mines mainly located in tropical and subtropical regions. On average it takes 4 to 5 tonnes of bauxite to produce 2 tonnes of alumina, yielding 1 tonne of aluminium. The main solid by-product of the alumina extraction (Bayer process) is red mud and roughly 3 tonnes is left for every tonne of alumina.

Recycling 1 kilogram of aluminium saves 5 to 8 kilograms of bauxite, 4 kilograms of chemicals and 14 kilowatts of electricity. It also produces 95 per cent less air pollution. As much of the bauxite is mined in the tropics and some in tropical forests; the recycling of aluminium also helps save tropical forests.

Mining waste generated from aluminium production

Sources: European Aluminium Association; *Nachhaltige Stadtentwicklung beginnt im Quartier*, Carsten Sperling et Oekoinstitut e.V. (Ed.), Freiburg, 1999.





Major bauxite producers

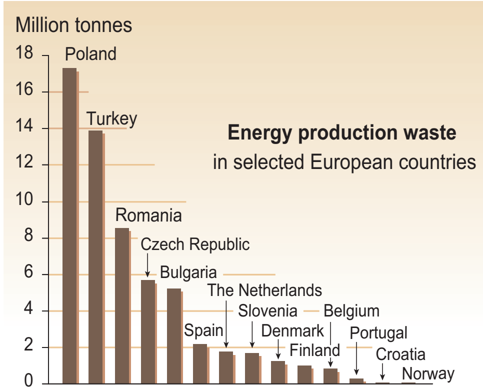
Source: US Geological Survey, *Mineral Commodity Summaries*, 2006 (figures for 2005)

ON THE WEB

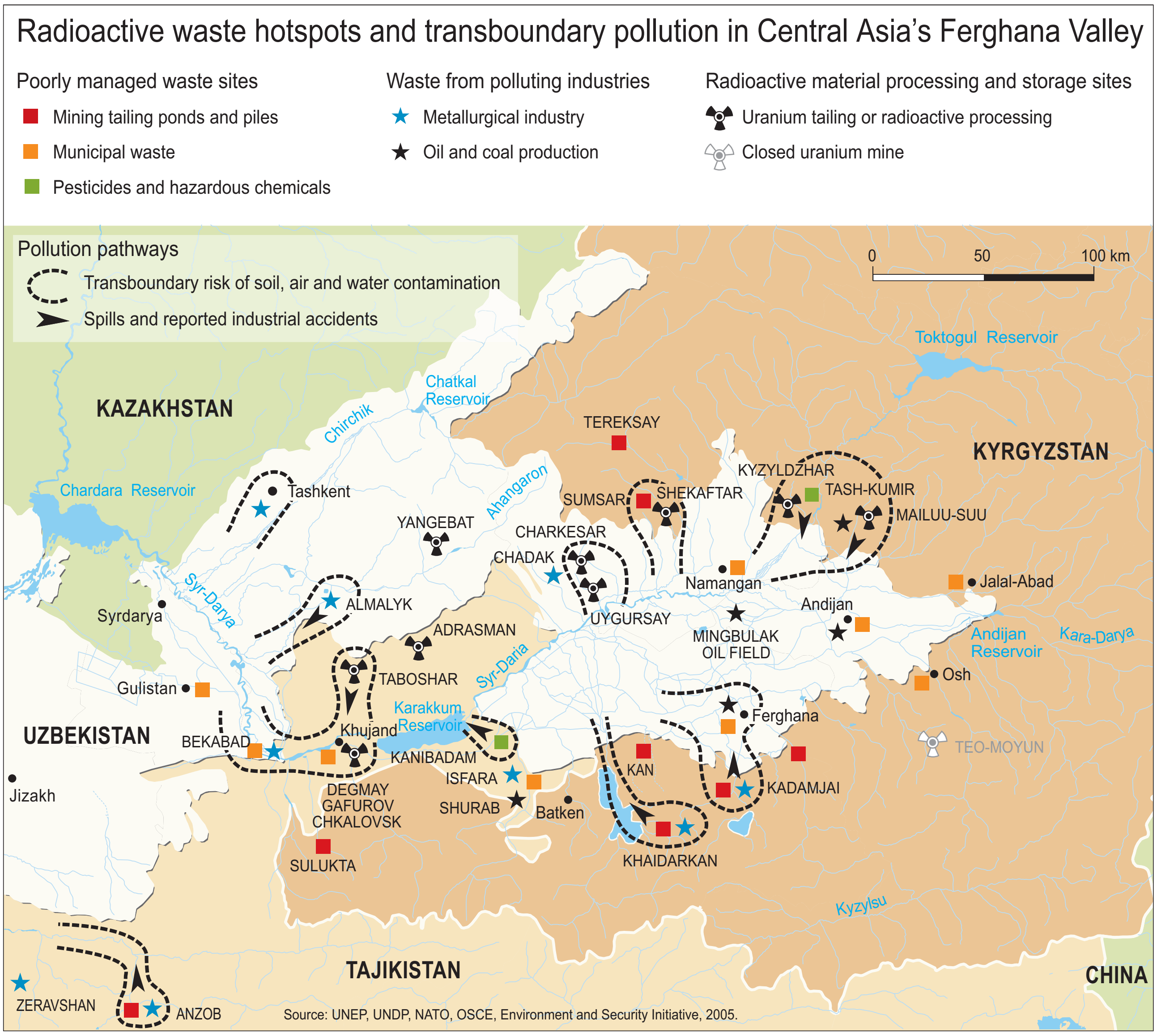
The UNEP/OSCE/NATO/UNDP publication on sustainable mining practices:
www.envsec.org/see/pub/mining-fullb.pdf
European Commision on mining waste:
ec.europa.eu/environment/waste/mining

No energy without waste

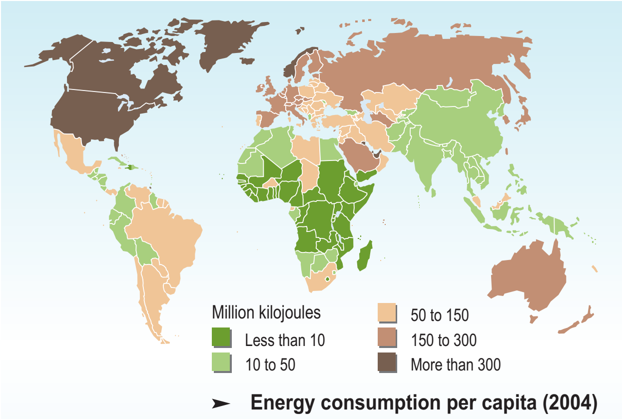
Many of today's products involve complex production processes that use large amounts of energy. Waste is a major environmental concern for the energy sector. Depending on the type of energy, the production process itself will generate substantial quantities of waste. The energy sector generates specific types of waste: waste from mining and upgrading coal and lignite (tailing); waste from oil and gas refining; combustion waste from thermal power stations; waste from air-pollution abatement devices and finally the components of the power station itself which must be dismantled at the end of its service life (particularly sensitive in the case of nuclear power stations).

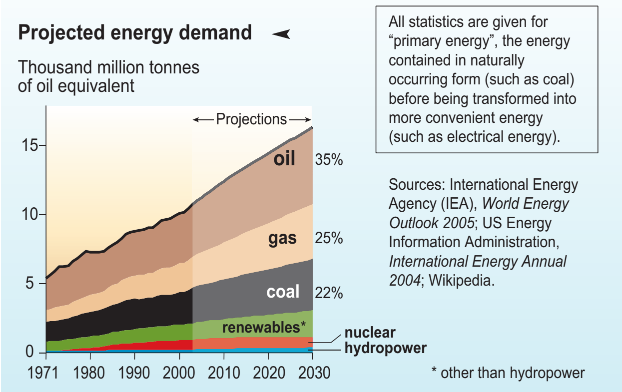


Source: EIONET, European Topic Centre on Resource and Waste Management, 2006 (figures for 2002).



The Soviet Union used the Ferghana Valley as one of its main sources of metal and uranium ore. The area has many nuclear waste storage sites, abandoned uranium mines with poorly secured tailing dams and nuclear reactors that pose a severe security hazard. Tailings are exposed to wind erosion and easily accessible to grazing animals. Local people are often unaware of the risks of exposure to radiation, using metal and tailing materials for building. Farmland borders tailing areas and children use waste storage sites as playgrounds.





According to current forecasts the world's energy requirements will have risen by more than 50 per cent by 2030. Oil and natural gas will account for more than 60 per cent of the increase.

ON THE WEB

International Energy Agency:
www.iea.org
German renewable energy site:
www.german-renewable-energy.com/Renewables/Navigation/Englisch

Polluting renewables?

Renewable energy sources include a variety of technologies that tap into existing energy flows, such as sunlight, wind, water, and other processes, in particular biodegradation and geothermal heat. Such sources can be replenished naturally in a short period of time and create little or no waste in their active phase.

For instance photovoltaic panels have very little impact on the environment, making them one of the cleanest power-generating technologies available. Some use small amounts of toxic metals such as cadmium and selenium, generating a certain amount of hazardous waste that nonetheless need to be properly disposed of. Photovoltaic panels operate for 25 years at least. In due course we will have to recycle four to 10 million tonnes of old or broken panels, but manufacturers have already set up the necessary processes. Ironically a lot of fuss is made about any waste caused by renewable technologies, yet the same level of cleanliness is rarely required of more conventional energy sources.

Conventional – non-renewable – energy sources include fossil fuels, primarily oil, natural gas and coal, and uranium, of which atoms are split (through nuclear fission) to create heat and ultimately electricity. They cannot be replenished within existence of mankind. They were created over millions of years.

The Radioactive Wager

Radioactive waste is a politically sensitive issue (to say the least). It includes spent fuels from power plants but also radioactive materials of all kinds (spent reactors, military equipment, etc.). Uranium mining leaves heaps of slag and uranium tailings (see Ferghana map for example).

Waste management strategies and technologies seek to protect human health and the environment. But it has so far proved impossible to dispose of radioactive waste completely. The only solution is to hide it as safely as possible. There is always a risk of uncontrollable outside events, but this tends to be glossed over.

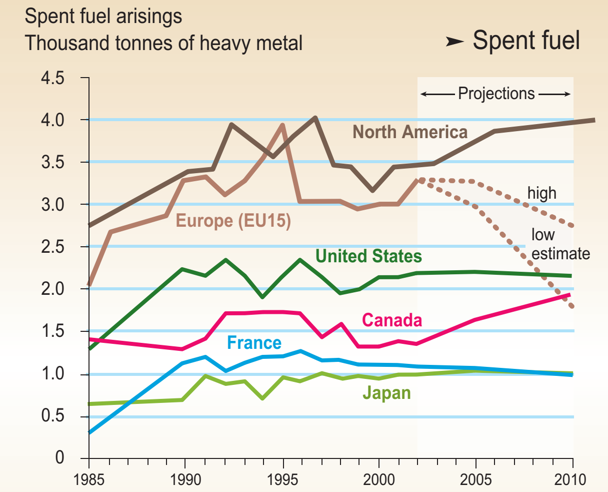
Spent Nuclear Fuel

Every 18 to 24 months nuclear power plants must shut down to remove and replace the "spent" uranium fuel, which has released most of its energy in the fission process and become radioactive waste. How best to store this waste has become an international issue. Some states, particularly Russia, expect high financial benefits from importing such waste. Western states facing strong public opposition to storing waste at home are only too happy to unload the problem elsewhere and export spent fuel. As with any hazardous waste transport, moving nuclear waste raises questions about the priority given to profit, rather than the safety of people in the importing country (see pages 34 to 36 for waste in transit).

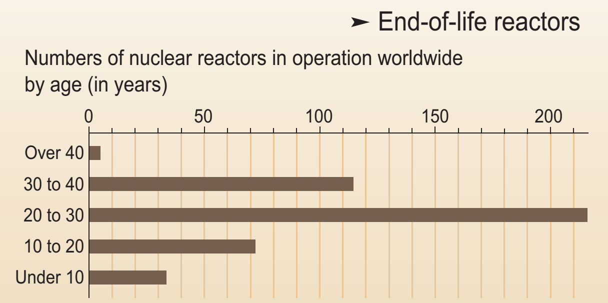
More than three-quarters of nuclear reactors currently in service are more than 20 years old. After an average service life of 30 years it takes 20 more years to dismantle them.

The spent fuel figures for 2002 are national projections. Quantities fluctuated strongly in the United Kingdom, partly due to variations in electricity output from nuclear power. Decommissioning of several older power stations explains the peaks.

Nuclear waste generation



Source: OECD Environmental Data, 2004.

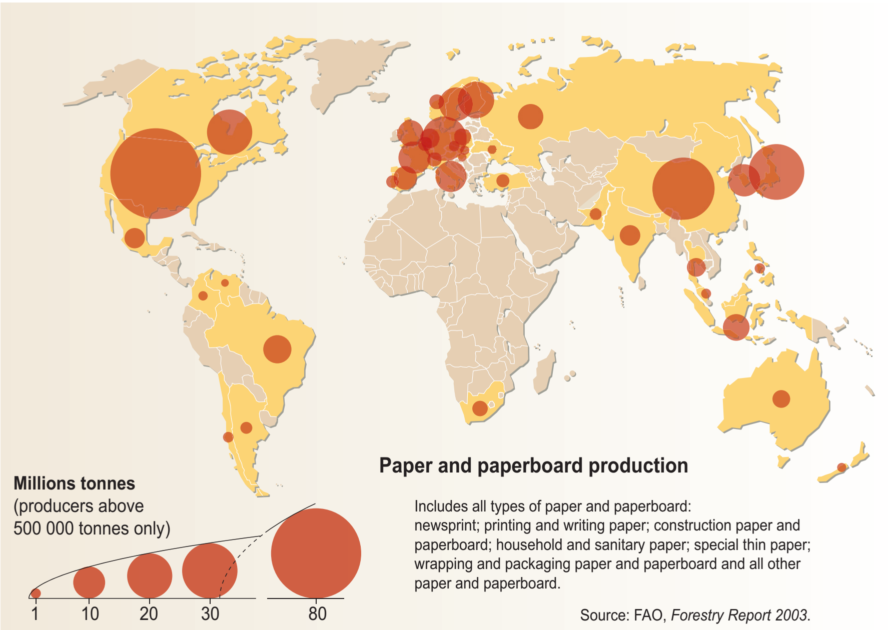


Sources: International Atomic Energy Agency's Power Reactor Information System; UNEP/GRID-Europe; UNESCO, 2006 (figures for 2005).

The big waste factory

Have you ever considered the volume of waste caused by manufacturing the little implement for cleaning your teeth? One toothbrush causes 1.5 kilograms' waste. About 94% of the materials extracted for use in manufacturing durable products become waste before the product is manufactured.

Industry is the top producer of waste in developed countries. A large proportion of industrial waste is hazardous, because industrial processes often involve chemicals. Cleaner production – reducing the amount of problematic components in a product and additives used in the production process – waste avoidance anda life cycle approach to waste management are attempts in the right direction. For some, this is not enough: they promote a complete rethinking of material use – only use components that have a positive influence on the environment! There is talk of a "new industrial revolution" and 'cradle to cradle design'.



Waste water stains on white paper

Though it is based on wood, a natural renewable resource, the pulp and paper industry is one of the worst sources of pollution. It absorbs more than 40 per cent of all timber felled worldwide. Despite the development of digital communications tools global paper production is expected to increase by 2.2 per cent a year from 330 million tonnes at present to 440 million tonnes worldwide by 2015. The main growth areas are Asia and Eastern Europe, but annual per capita consumption in Western Europe is also expected to rise from 207 kilograms currently to 264 kilograms.

Regulations and legislation introduced in Europe and North America in recent years require improved production processes both in terms of energy consumption, resource usage and pollution control. Bleach-free production is technically possible now and water pollution could be cut to a minimum. Thanks to labels that communicate environmental standards, consumers could and should be aware of the possibilities of choosing paper with less environmental impact.

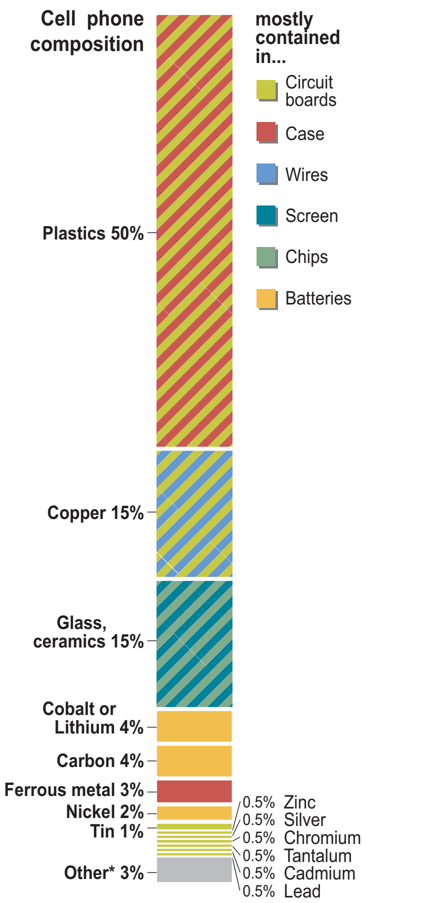
Transferring production from Europe and North America to other parts of the world where standards tend to be lower (China, South America) partly outweighs these gains.

Producing paper differently

The Julius Schulte Söhne GmbH paper mill in Düsseldorf manufactures paper from recycled waste paper, with zero effluents. Thanks to proprietary technology the mill cleans its own waste water and reuses it. It thus saves some 260 000 cubic metres of water and €400 000 in sewage expenses. The gas produced by the effluents is scrubbed to remove the sulphur and used to generate electricity, covering all the requirements of the mill.

From 2009 the Forscot mill in Scotland plans to produce paper in a fully integrated mill supplied by timber from Scotland and the north of England, delivered by train or boat. Waste materials (bark, sawdust, etc.) and effluents linked to pulp production will be used for the mill's electrical power supply. About 90 per cent of the 144 megawatt output will be used on the spot, the rest being fed into the power grid. Forscot plans to produce about 970 000 tonnes of paper and pulp, of various grades, primarily targeting customers in the United Kingdom, where demand is high. Deliveries will be made by rail or sea.

For an example of how waste from the paper industry can be reduced by reusing paper directly see pages 30–31.



*among them, less than 0.1% of antimony, gold and berrylium

Sources: Basel Convention, 2006; Lindholm (Nokia report), 2003.

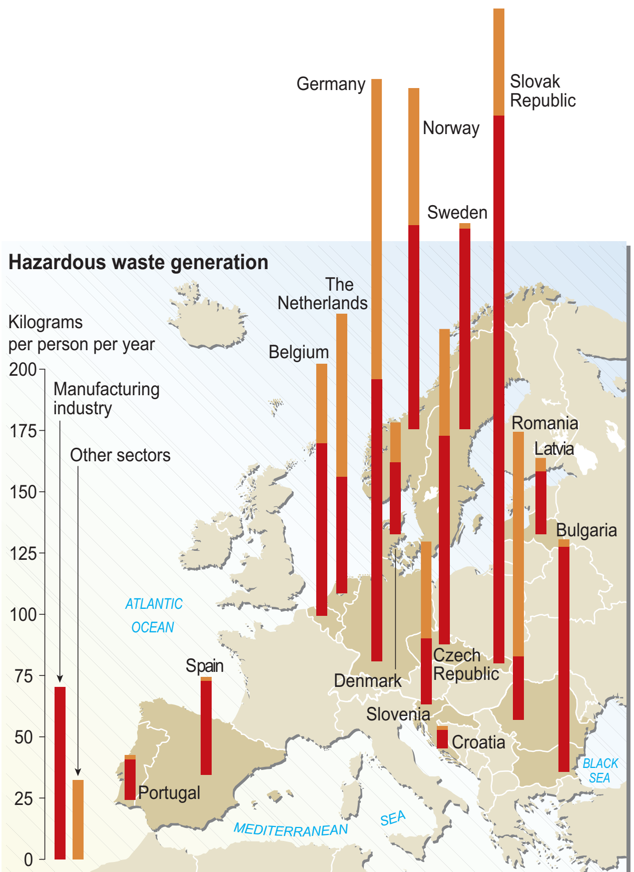
ON THE WEB

UNEP's Division on Technology, Industry and Economics:
www.unep.fr/en/about
International Society for Industrial Ecology:
www.is4ie.org
Invergordon paper mill:
www.forscot.com

Made in elsewhere

It is impossible to detail all the types of waste directly or indirectly involved in manufacturing mobile phones. In developed countries production processes manage to keep sensitive materials in a closed circuit, without any waste escaping to the outside world. Production – "Made in Elsewhere" – does not usually take place where the phones are most widespread. It is unlikely such a high degree of efficiency can be achieved in the countries where many mobile-phone components are assembled, particularly as environmental rules are often difficult to implement there. Assembly workers can be exposed to a mixture of toxic chemicals, with waste finding its way into the atmosphere, ground and water supply, posing a serious risk to their health and that of the people living in the neighborhood.

Let us take three of the most hazardous metals for both the environment and human health. Lead is used in monitor screens, in solder for mounting integrated circuits (chips) on printed circuit boards (the brains of your phone). Microprocessors contain mercury. And there is cadmium in the circuits and battery (mobile phones use 60 per cent of rechargeable batteries produced worldwide).



Source: European Commission, Eurostat, Theme Environment and Energy, *Waste generated and treated in Europe. 2005 Edition* (figures for 2002).

Typical hazardous wastes
generated by selected manufacturing industries

Wastes	Industry
Strong acids and bases Reactive wastes Ignitable wastes Discarded commercial chemical products	Chemistry
Tanning liquor and effluent treatment containing chromium Dyestuffs and pigments containing dangerous substances	Leather and textile
Paint wastes containing heavy metals Strong acids and bases Cyanide wastes Sludges containing heavy metals	Metal
Ignitable and corrosive wastes Ink wastes, including solvents and metals Photography waste with heavy metals solutions	Paper and printing
Heavy metal dusts and sludges Ignitable wastes Solvents Strong acids and bases	Cleaning and cosmetic
Ignitable wastes Spent solvents Paint wastes	Furniture and wood
Paint wastes Ignitable wastes Spent solvents Acids and bases	Vehicle maintenance shops
Animal waste (not always hazardous) Cleaning wastes CFCs (refrigerants)	Food and beverages

Sources: UACPA, 2002; Commission Decision 2001/118/EC on the European List of Wastes (2001).

PACKAGING WASTE

The packaging nightmare

Packaging represents a growing share of the average household's waste, particularly if you consider not only its weight but also its volume. There are many reasons for this increase: smaller households, increasing use of convenience food (ready-made meals) at home and on the move, and higher food hygiene standards. All these factors encourage the use of disposable packaging and individual portions. But above all packaging is a key component in international trade. Fifty years ago most of what we consumed was produced nearby. Today even basic goods such as water travel halfway round the world to reach us (see following page). Last but not least, packaging is a major marketing tool, a vector for brand names and consumer values.

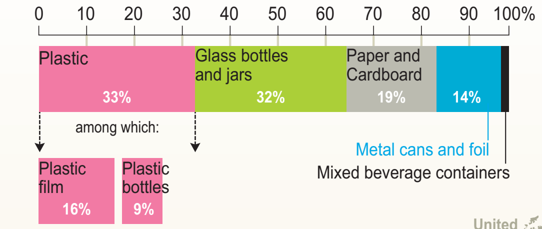
The manufacture of packaging itself generates waste and by definition it has a particularly short lifespan. It turns into waste as soon as its contents reaches its destination. This is certainly a blessing for the packaging sector – and the related plastics, paper and printing industries – but it presents a serious challenge for waste management (see also pages 24–25 and 26–27).

Packaging of all kinds

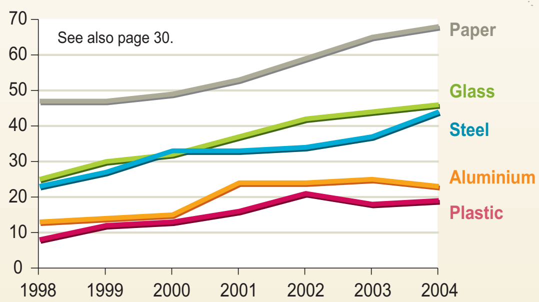
Once a product is manufactured and ready to be sold, it must be distributed. To protect it from dirt and shocks, to make it easier to store, but also to make it look appealing, a whole science has developed to design the most suitable wrappings. The variety of products demands a huge diversity of packaging and a wide range of materials: cardboard boxes, glass jars, plastic bags, plastic film, aluminium wrappers and expanded polystyrene, to name just a few.

Part of it is reused or recycled with varying efficiency depending on the degradability of the components and the efficiency of the recycling chain (collection and processing).

Packaging waste composition in the UK
in percentage of total packaging waste



Recycling rates of different packaging material
in percentage of the specific packaging waste produced



Sources: UK Department for Environment, Food and Rural Affairs, *e-Digest of Environmental Statistics*, 2006; Julian Parfitt, WRAP as cited in *Cool Waste Management*, Greenpeace, 2003.

Plastic packaging

According to Residua, a UK company working on solid waste issues, about 50 per cent of European goods are wrapped in plastic (17 per cent by weight). There are many types of plastic packaging: plastic bottles are often made of polyethylene terephthalate (PET), yoghurt pots are mostly polypropylene (PP), wrapping film, bin liners and flexible containers are usually low-density polyethylene (LDPE) and so on. This diversity partly explains why recycling rates for plastics are low: each type of plastic needs its own recycling process.

Most plastics are derived from oil or gas, the extraction and processing of which requires large amounts of chemicals and, of course, generates waste (including hazardous waste).

Facts

One plastic bag takes 1 second to manufacture, is 20 minutes in use, and takes 100-400 years to degrade naturally.

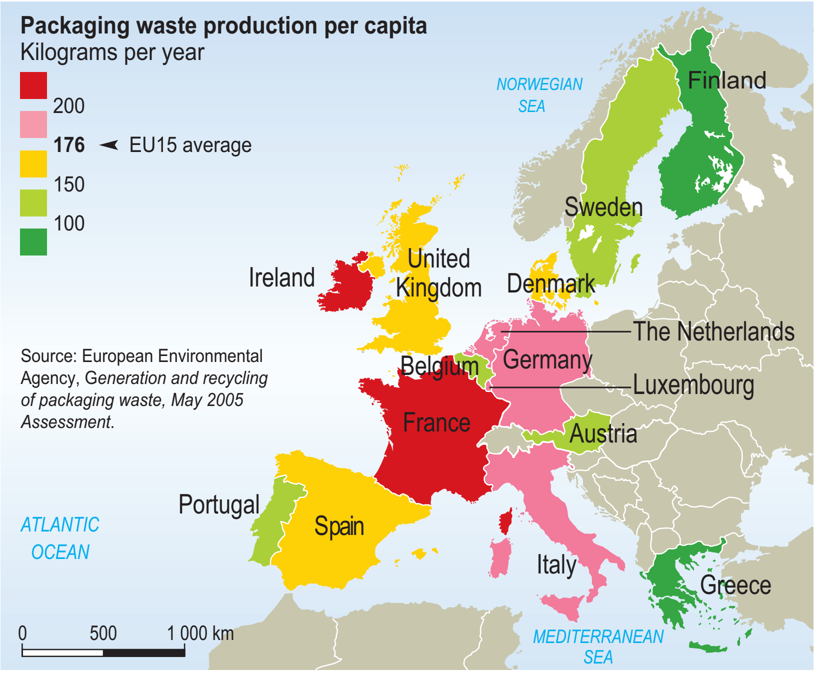
500 thousand million bags a year distributed worldwide, or 16 000 a second

60 000 tons of plastic are used in France alone to produce disposable plastic bags.

At your level:
Consume local produce (especially fresh food);
Drink tap water and advocate protecting its quality;
Take your own reusable bag when you go shopping;
Choose containers that are easy to reuse and recycle;
Buy in bulk when possible;
Boycott over-packaged products and individual portions.

ON THE WEB

WRAP (Waste and Resources Action Programme):
www.wrap.org.uk
Packaging Recovery Organisation Europe:
www.pro-e.org
Evaluation of European packaging waste management systems:
reports.eea.europa.eu/eea_report_2005_3/en/FINAL-3_05-Packaging_waste_WEB.pdf

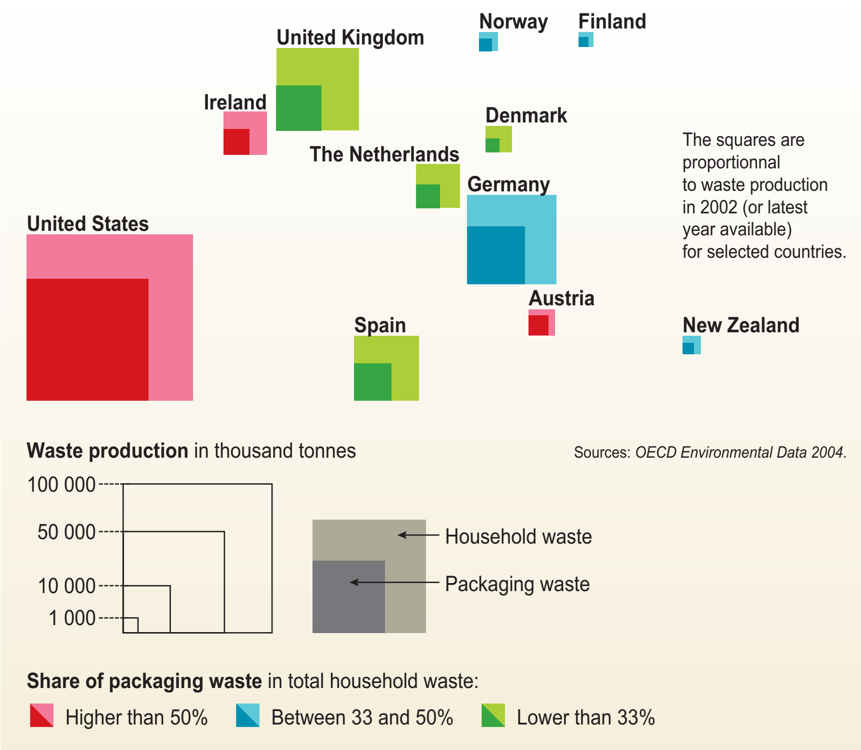


Source: European Environmental Agency, *Generation and recycling of packaging waste, May 2005 Assessment.*

Invading the landscape

Plastic bags are given away in huge quantities by grocery stores and supermarkets all over the world. The bags are not degradable and end up on dumps or in the wild, spotting landscapes with flickering coloured dots. The bags certainly come at a cost, but it is well hidden in the price of our purchases and, as consumers, we tend to forget we could avoid this surcharge (and the extra waste) by bringing our own bag.

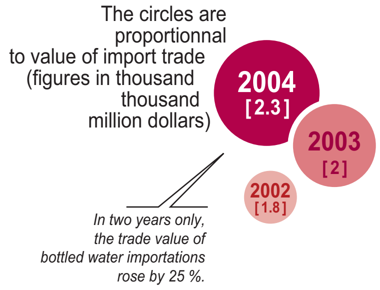
Some countries are launching drives to ban plastic bags or replace them with more sustainable containers (raising some interesting scientific debates on less resource-intensive options). But there is growing concern in developing countries especially in Africa. The increased use of plastic bags is particularly noticeable in the new economies of the former Soviet Union, where only a few years ago a plastic bag was treasured as an important belonging and washed endlessly for careful reuse.

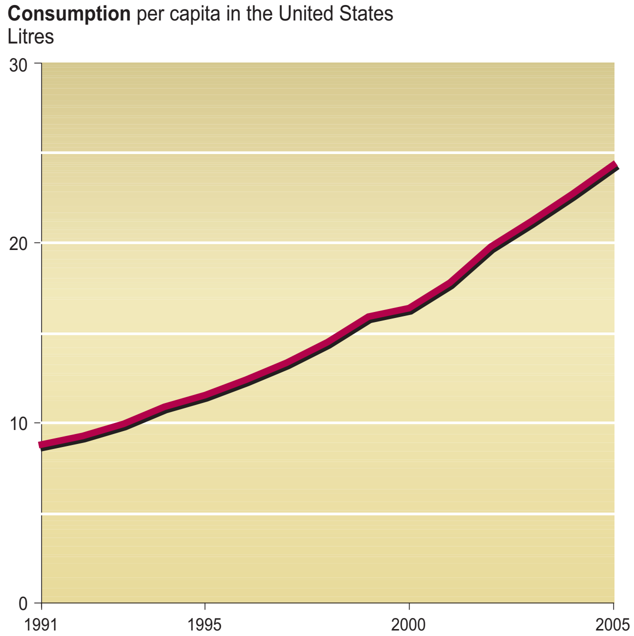


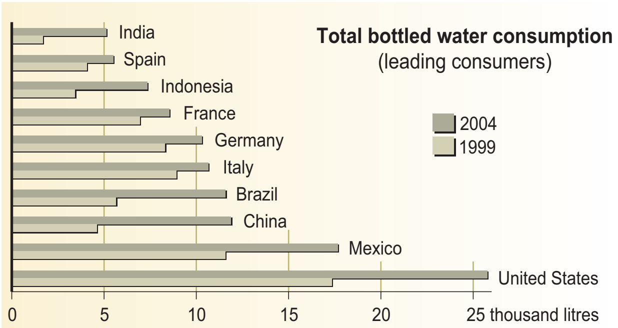
Sources: *OECD Environmental Data 2004.*

Message ’round a bottle

It seems understandable nowadays that Iceland might need to import fresh produce from abroad or that North America and Western Europe should want to bring spices from Asia. But if we look more closely much of the trade criss-crossing the globe defies common sense. Why would the United States import so much meat from Australia? Why would Canada import bottled water from France when the country exports a large share of its own output to the US and Japan?







Sources: International Bottled Water Association, 2005; Beverage Marketing Corporation, 2005.

Trade for trade’s sake

Why would any country import goods already produced at home or nearby? One explanation is straight forward: It may be cheaper to buy abroad than produce locally or the necessary know-how is not available locally. In some cases a famous brand or the country of origin is a guarantee of quality. Such explanations only account for part of the truth. The single most important factor for people wanting such and such a brand of water is clever advertising (see page 21). One of the reasons this system can work is that transport costs do not reflect the full story, disregarding the long-term cost of environmental damage (in terms of waste but also energy resource depletion and climate change).

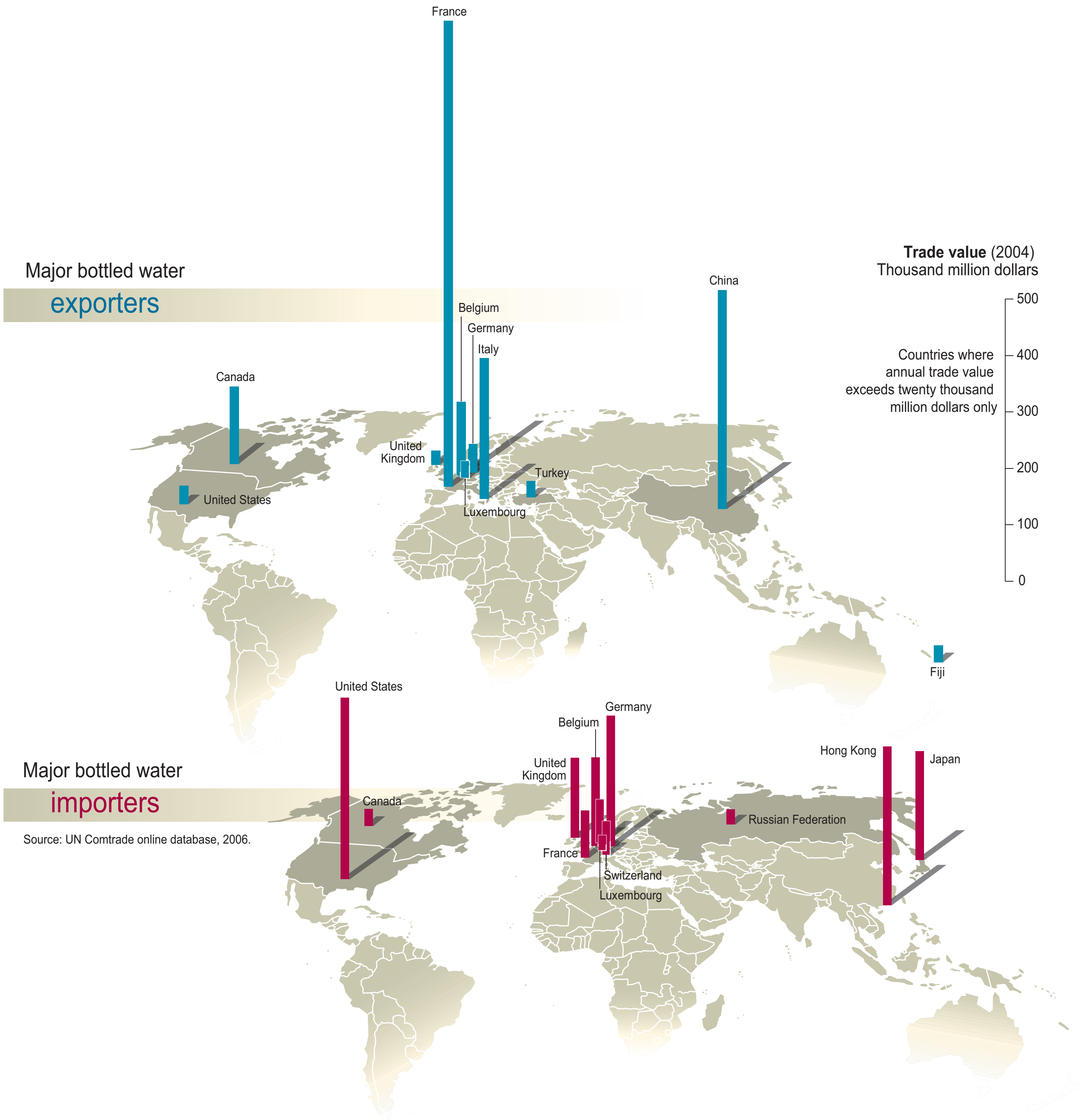
Bottled water is a typical case. Powerful marketing strategies and increasing suspicion towards tap water have made mineral water a fast growing market (a largely unjustified suspicion for that matter because tap water is subjected to more regular quality controls than bottled water, at least in large cities).

The maps illustrate the crazy logic of today’s global trade. Exchange is no longer based on local needs or resource availability (in most countries where large amounts of bottled water are consumed, the tap water is perfectly drinkable), with unnecessary exchange involving major importers that are also major exporters (France, Germany and Belgium).

It goes without saying that bottled water requires large amounts of plastic, for a container that has a very short life span and takes a very long time to biodegrade.

ON THE WEB

Bottled Water:
www.bottledwater.org

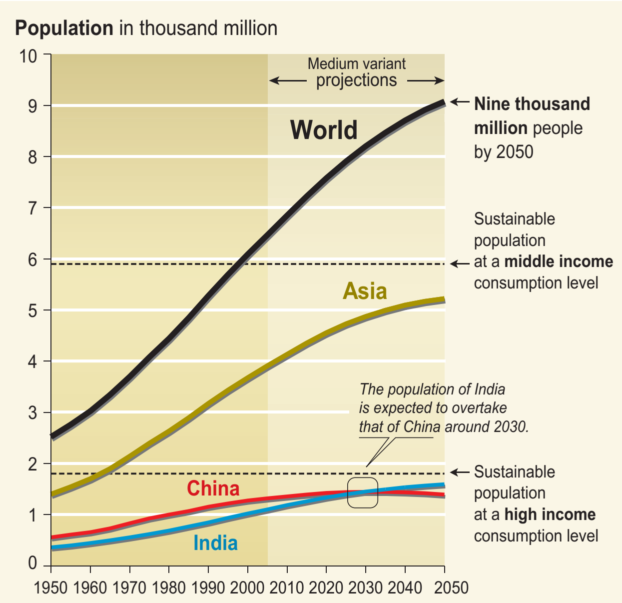


Source: UN Comtrade online database, 2006.

Consumption worlds

Since the post-war enthusiasm of the 1950s the word “progress” has enjoyed a special aura, for generalising goods that make our life easier. All over the world people can buy goods at increasingly affordable prices. Though this easy materialism enables some people to enjoy greater comfort others seem overwhelmed by the speed with which consumer objects multiply. Very few families have resisted this trend and are still in phase with their culture.

The cost of all these products for the environment is colossal. The goods we accumulate today will pile up as waste tomorrow, and more yet in view of the global trends. Projections tell us that there will be 9 000 million people on Earth by 2050. According to the Global Footprint Network life on Earth would not even be sustainable for 2 000 million people consuming at the same rate as in the richest countries today. Unless we change the way we produce (see pages 12–13) and consume.

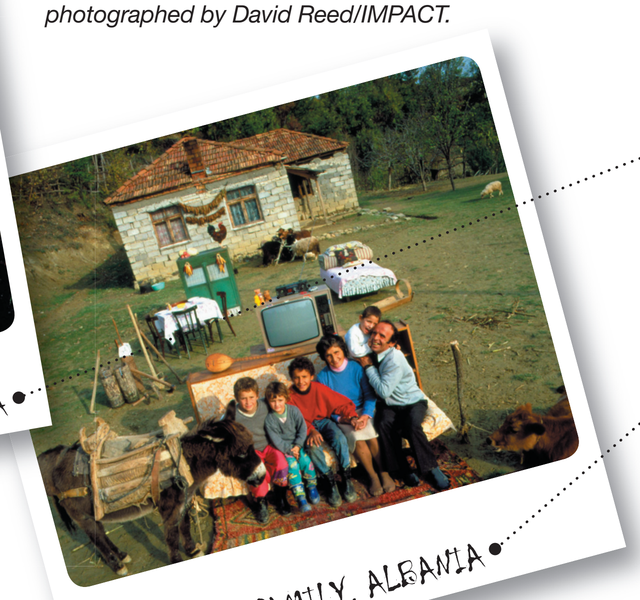


Sources: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2004 Revision*; Global Footprint Network, 2005.

THE DE FRUTOS FAMILY, SPAIN

Photographs from a project by the American photographer Peter Menzel. In 2001 he took pictures of 30 middle-class families outside their home with all their possessions, in 30 different countries, publishing his findings in Material World, see www.menzelphoto.com. The Hodson family was photographed by David Reed/IMPACT.

THE CALABAY SICAY FAMILY, GUATEMALA



THE CAKONI FAMILY, ALBANIA

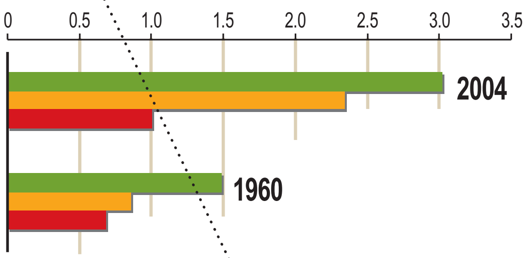
ON THE WEB

Global Footprint Network:
www.footprintnetwork.org
Population and development in the United Nations system:
www.un.org/esa/population

THE HODSON FAMILY, UNITED KINGDOM

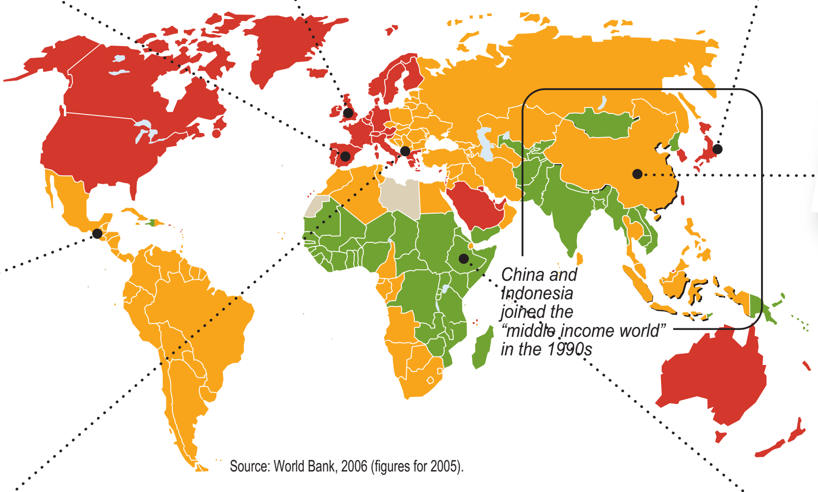
THE KAZUO UKITA FAMILY, JAPAN

Population by income level
Thousand million



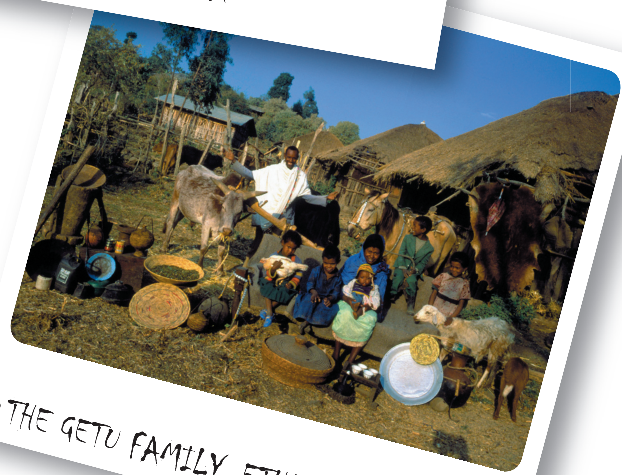
Consumption level

- Low income
- Middle income
- High income
- No data



Source: World Bank, 2006 (figures for 2005).

THE WU FAMILY, CHINA



THE GETU FAMILY, ETHIOPIA

The rich world consumes more and thus produces more waste. The World Bank classification based on gross national income per capita is an indication of the global consumption level. Over the last two decades the world as a whole did not get any richer but China and Indonesia, two densely populated countries, entered the "middle income world", as defined by the World Bank. Consumer items are available to a growing number of individuals, particularly in the two countries. If they cannot disconnect economic growth from resource depletion and energy use, they will not be able to enjoy their new-found wealth for very long.

The relativity of “Basic Needs”

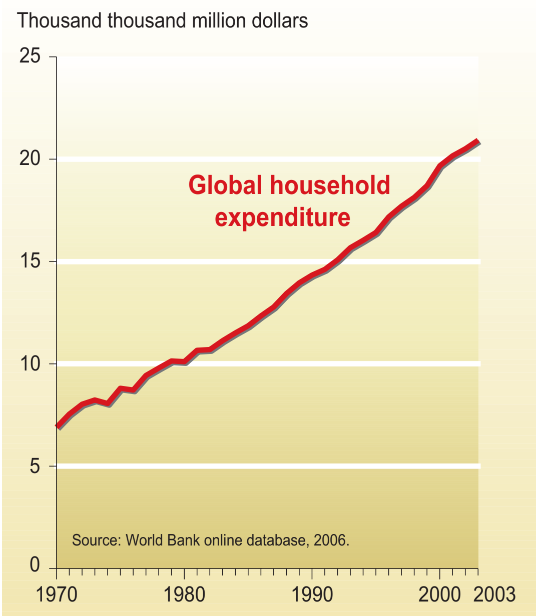
Several trends characterise modern consumer goods. Our appetite for them continues to grow, with product ranges growing too. Meanwhile the average lifespan of many products is shortening. 80% of what we make is thrown away within six months of production. Each product contains more components and they are usually more difficult to biodegrade than before. All of which complicates the way products are processed once they become waste.

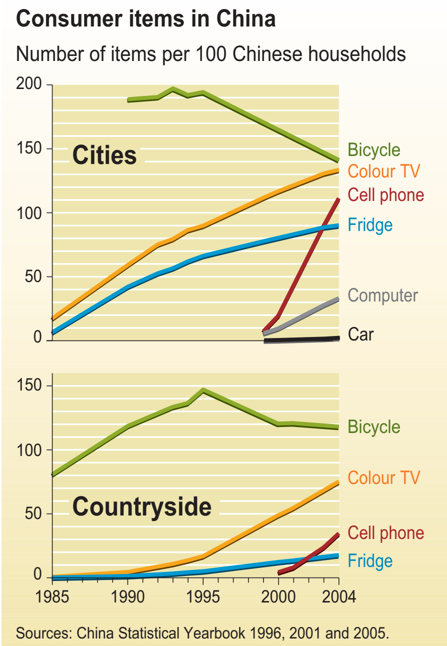
New products

The electronic era that started 30 or 40 years ago has revolutionised the way we work and communicate. Digital devices are omnipresent in business and in everyday life. But a closer look shows they are not always essential. They are governed by fashion and innovation, so we “have” to buy the latest gadget increasingly often, turning the previous one into electronic waste all the sooner. For instance ten years ago we used a notebook as a diary. Now even schoolchildren “need” an energy-hungry electronic for a similar purpose.

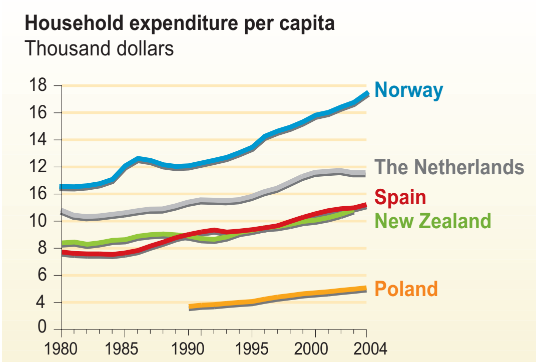
Gadget today, garbage tomorrow

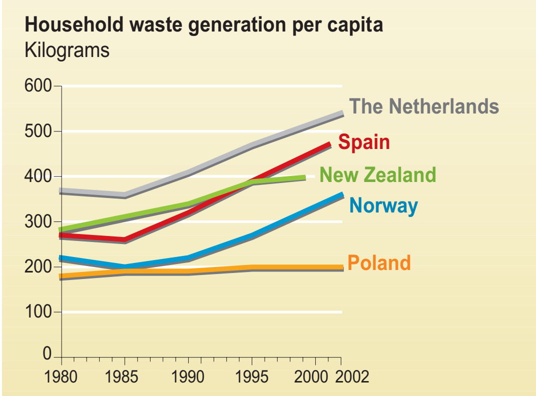
Our modern world is full of gadgets we can have for free: a plastic ball in the cereal pack or a hand bag with the perfume. Start a new cellphone contract and pick up a mobile. Subscribe to the daily newspaper and get a TV magazine too. As we never wanted them in the first place, these gadgets turn into trash even faster than other goods.





The impact of income on lifestyle is apparent in China like elsewhere. There has been a massive surge in all consumer goods with rising income in towns. The same trend can be observed to a much lesser extent in the country.





Sources: World Bank online database, 2006; *OECD Environmental Data 2004.*

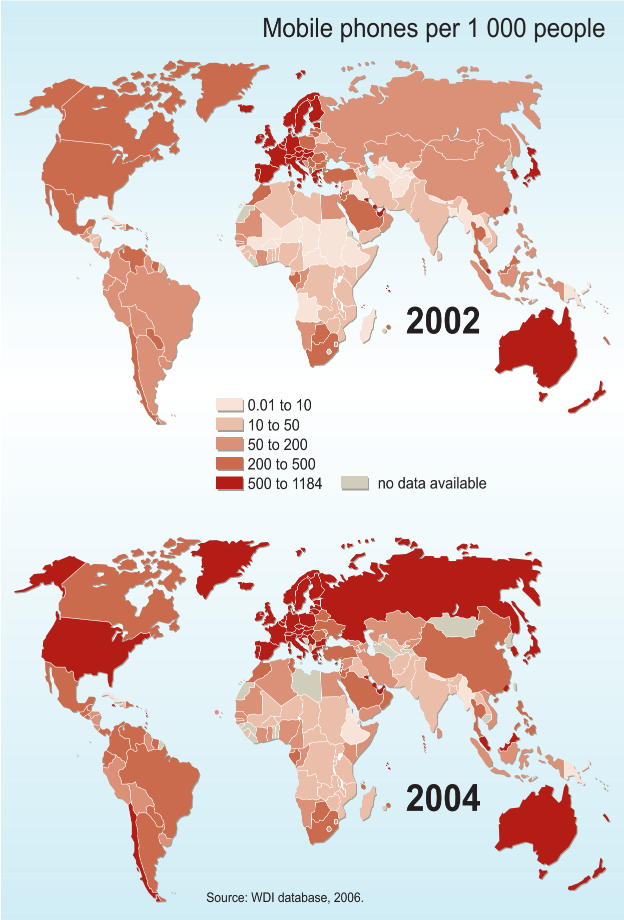
ON THE WEB

Key statistics from the International Telecommunication Union:
www.itu.int/ITU-D/ict/statistics
China Statistical Yearbook:
www.stats.gov.cn/tjsj/ndsj/2005/indexeh.htm

Mobile phone growth

Mobile phones were launched in 1984 and the market has been booming ever since. In 20 years they have spread like wildfire. By September 2004 there were 344 million subscribers (out of a population of 380 million) in the 15 (old) members of the European Union. According to Nokia there will be 2 000 million cellphone users worldwide by 2008.

Whereas in 2002 only 13 persons out of 1000 in Algeria and 474 persons out of 1000 in Lituania owned a cell phone, the number is now 145 and 996, respectively. In Africa cell phones have enjoyed almost 40% growth since 2000, though market penetration is very uneven. In many countries with poor coverage by land lines, cell phones are the only means of communication.

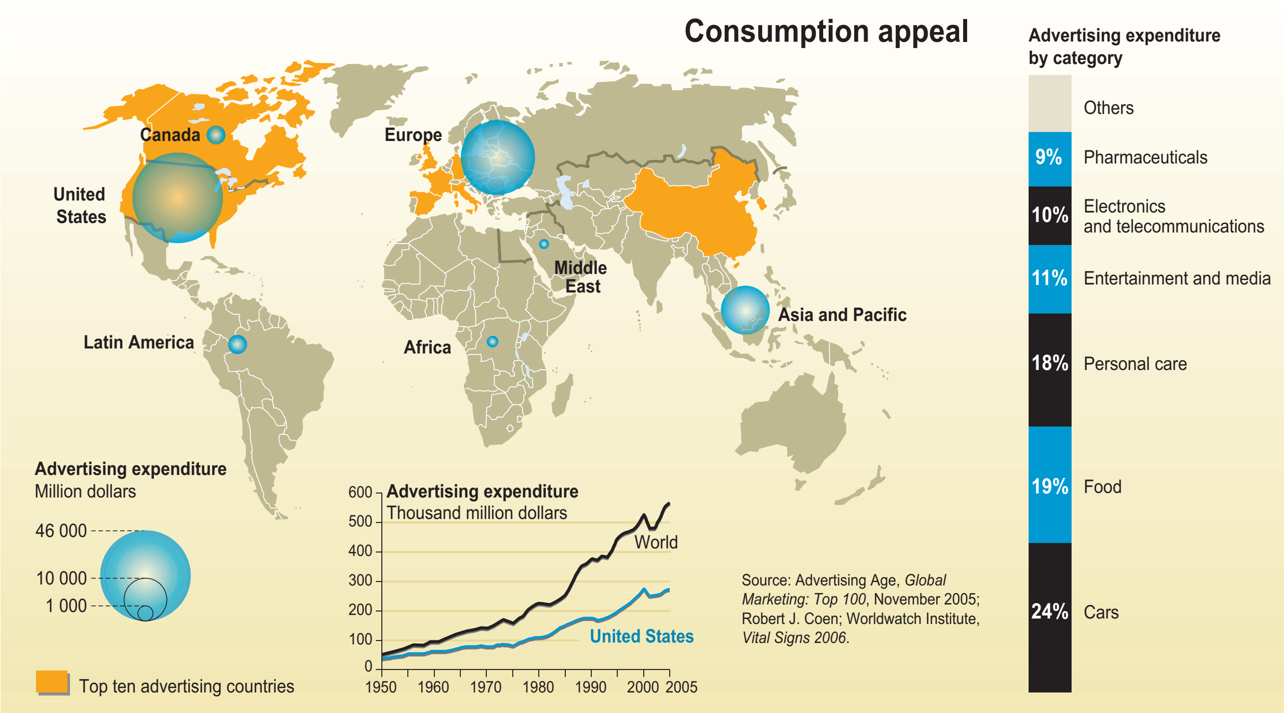


Throw-away culture

The list of products we used to keep for years and now dispose of instantly is almost endless: tissues, face wipes, razors, kitchen wipes, serviettes, nappies, plastic bags, toner cartridges, cameras and barbecues, to name just a few. Every year US consumers throw away 39 thousand million tonnes of cutlery and 29 thousand million tonnes of plates.

Inventing new demand

The marketing and advertising industry is constantly teasing us with trendy, cool and largely superfluous products. To judge by investment in advertising, it takes more and more to achieve the same effect. With all that stimulation it is an effort asking just what we stand to gain.



Counting the bins

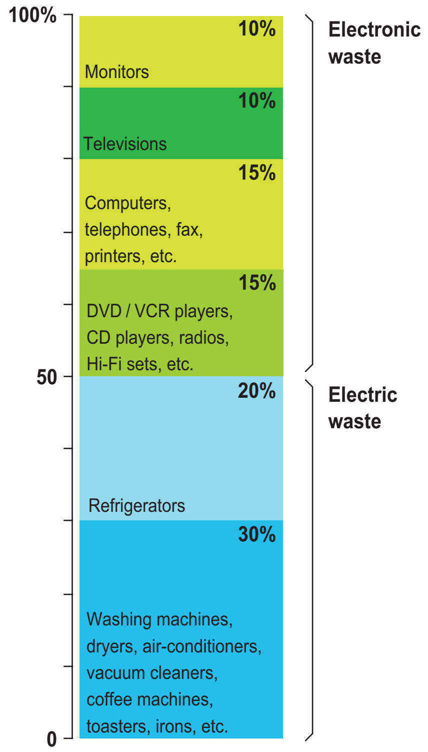
One person's dustbin is not the same as another's. Depending on which continent you live on, on your life style, financial resources, and so on, your trash will be different. On average, European households produce roughly one kilogramme of waste per person per day; in a number of developed countries this average is even higher. In emerging countries, particularly rural areas with limited contact with the western world almost all domestic waste can still be composted. In rich countries it is almost the exact opposite. The amount of compost-ready waste is dropping and now only accounts for a third of household waste. In France packaging represents half the total waste and is steadily increasing. Not only do we overpack goods, but also we increasingly tend to consume them in individual portions, which obviously results in more packaging. Buying coffee in individual pods, for instance, demands ten times more packaging than a 250 gram pack.

Compost from waste food (from works cafeterias, vegetables from markets, garden cuttings, etc.) is valuable. Once it has decomposed it enriches the earth. It seems clear enough we should not wreck nature with the contents of our bins, why then should we continue leaving nature in our bins?

E-waste: a toxic time bomb

A growing share of municipal waste contains electronic or electric parts. E-waste is one of the fastest growing waste streams and makes up approximately 4 per cent of municipal waste in the European Union. In the US, between 14 and 20 million PC's become obsolete every year. The picture is the same all over the world and e-waste is increasing steadily. In 2004 some 183 million computers were purchased worldwide, an 11.6 per cent increase on the previous year. The same year we bought 674 million new mobile phones, compared to 471 million in 2003 (a 30 per cent increase). On average people in developed countries only keep a computer for two years and mobile phones last even less time. The rising tide of e-waste also includes notebook computers and similar handheld devices, televisions, radios, DVD and video players, etc. So there is little likelihood of it stopping in the immediate future. In Europe e-waste is increasing by 3 to 5 per cent annually, almost three times faster than the total waste flow. As for developing countries they are expected to have tripled their e-waste output by 2010. For the planet as a whole e-waste currently represents 5 per cent of all solid municipal waste. For the planet as a whole e-waste currently represents 5 per cent of all solid municipal waste. Pages 12–13 (manufacturing) and 30–31 (recycling) tell more about the hazards arising from these growing piles of electronic wastes.

What is e-waste?



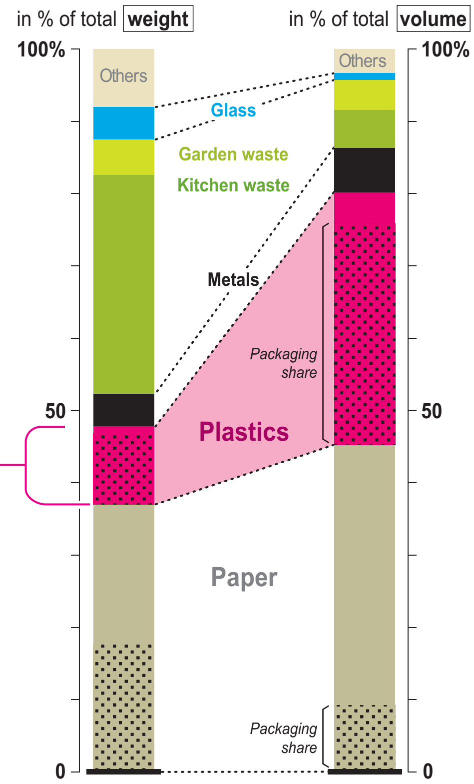
Additional categories: lighting equipment (fluorescent tubes); toys, sports and recreational equipment; electric and electronic tools (drills, sewing machines, lawn mowers, etc); surveillance and control equipment; medical instruments; automatic ticket machines.

Source : EMPA Swiss Federal Laboratories for Materials Testing and Research (definition according to the European Union WEEE Directive).

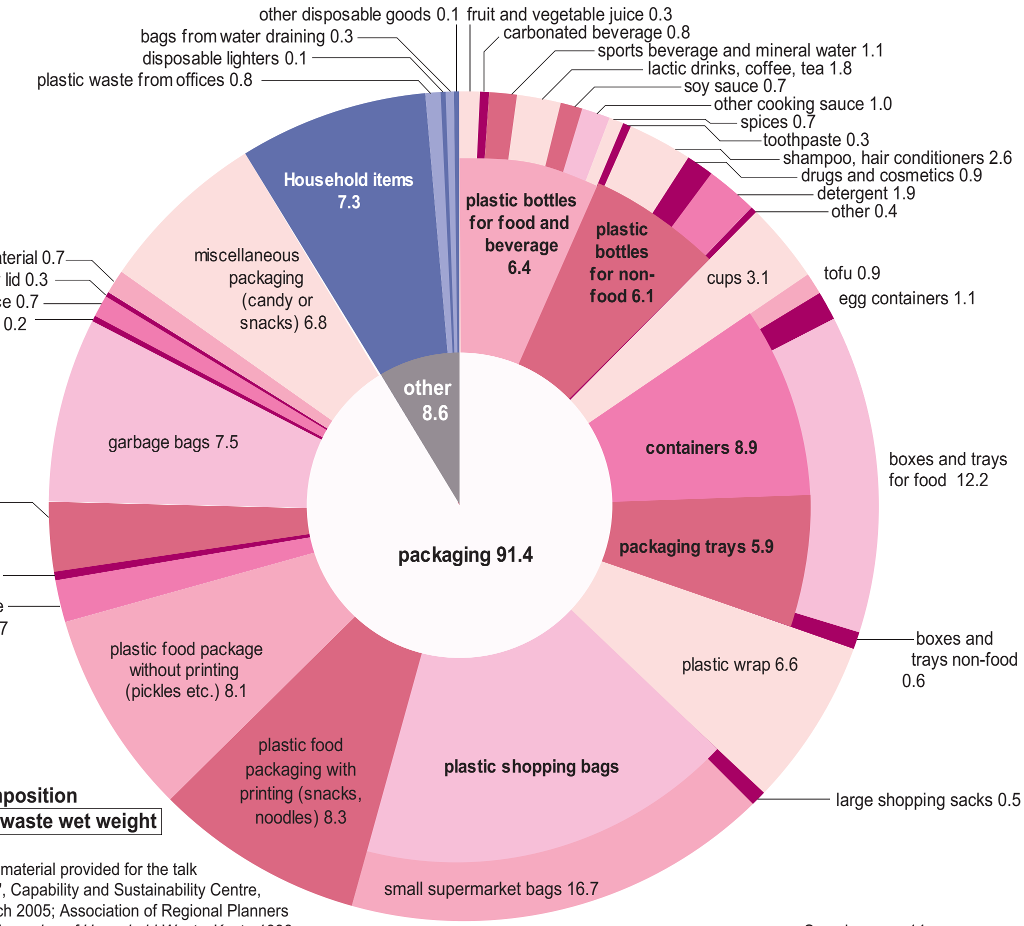
ON THE WEB

A simple and practical guide to household waste management:
www.purdue.edu/dp/envirosoft/housewaste/src/dispose.htm
e-waste:
www.ewaste.ch

Japanese household waste composition (Neyagawa case study)



The plastic share of a Japanese garbage bin (Osaka case study)



Household plastic waste composition in percentage of total plastic waste wet weight

Sources: Kohei Watanabe, Reference material provided for the talk "*Waste and Sustainable Consumption*", Capability and Sustainability Centre, St Edmund's College Cambridge, March 2005; Association of Regional Planners and Architects, *Detailed Sorting and Measuring of Household Waste*, Kyoto 1998.

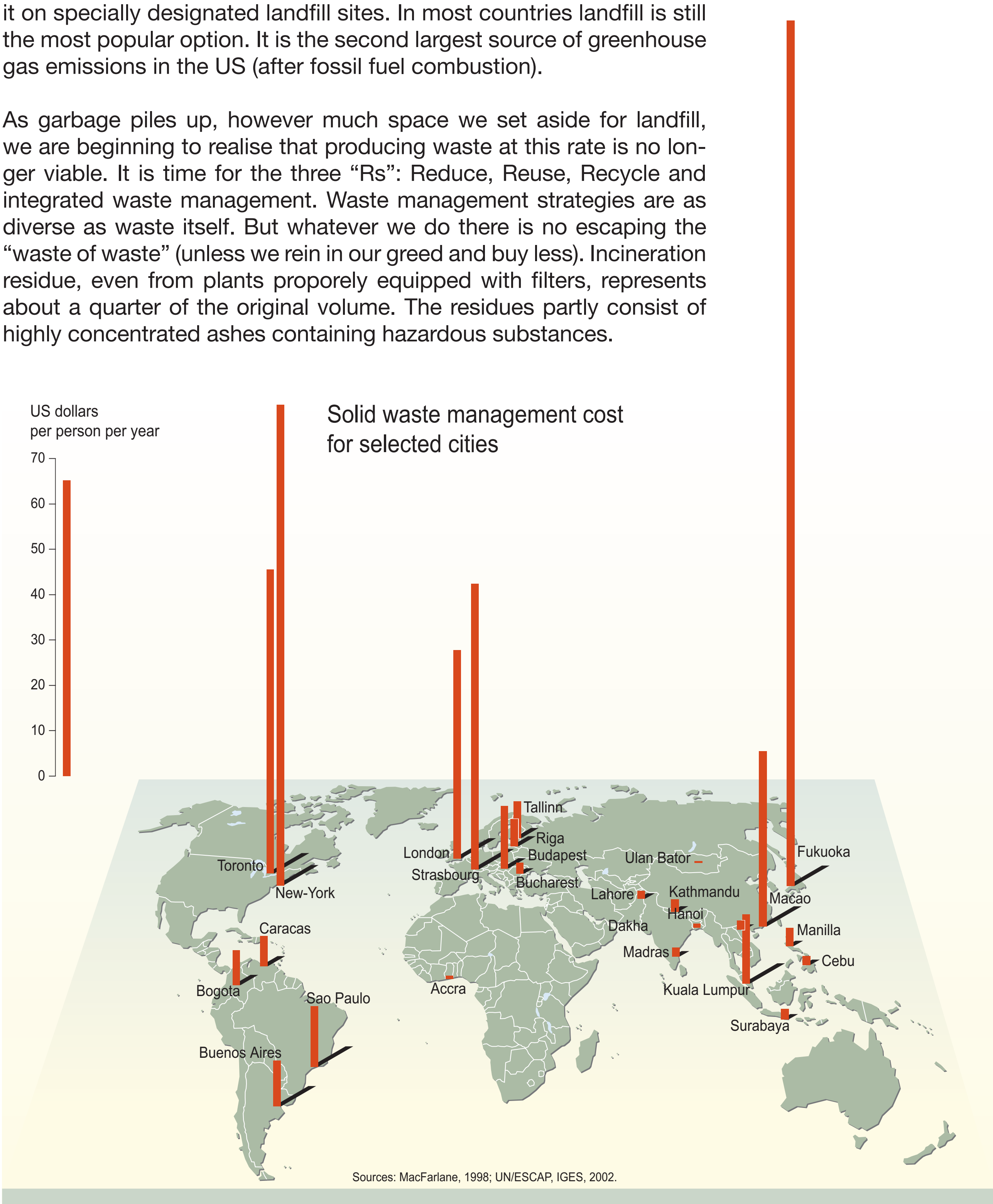
See also page 14.

WASTE MANAGEMENT

Dump, bury or burn?

Not long ago the amount and composition of waste was such that it could be simply diluted and dispersed into the environment. Most items were reused and only a few remained, that would not decompose naturally. With industrialisation and rising urban density, a new concept followed: collect and dump out of sight. The aim was to eliminate waste or at least protect the population from it. This generally involved either openly burning it (still practised today in many countries, this is a major source of toxic gas emissions such as dioxins and furans) or dumping it on specially designated landfill sites. In most countries landfill is still the most popular option. It is the second largest source of greenhouse gas emissions in the US (after fossil fuel combustion).

As garbage piles up, however much space we set aside for landfill, we are beginning to realise that producing waste at this rate is no longer viable. It is time for the three "Rs": Reduce, Reuse, Recycle and integrated waste management. Waste management strategies are as diverse as waste itself. But whatever we do there is no escaping the "waste of waste" (unless we rein in our greed and buy less). Incineration residue, even from plants proporely equipped with filters, represents about a quarter of the original volume. The residues partly consist of highly concentrated ashes containing hazardous substances.

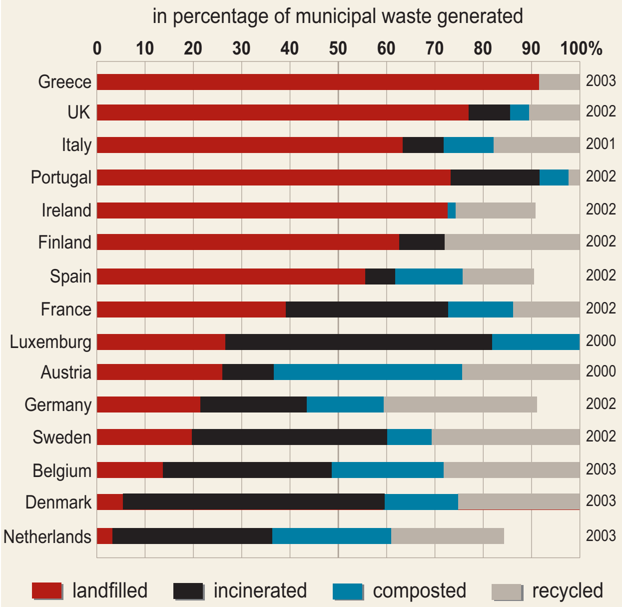


Sources: MacFarlane, 1998; UN/ESCAP, IGES, 2002.

ON THE WEB

Association of Cities and Regions for Recycling and sustainable Resource management (ACR+):
www.acrplus.org
Example of national waste reduction initiative:
www.zerowaste.nz
Interactive game to understand waste management by the US Environmental Protection Agency:
www.epa.gov/recyclecity

Waste management choices in Europe



Source: European Topic Centre on Resource and Waste Management, 2006; *OECD Environmental Data 2004.*

Managing hazardous waste

Everyday products increasingly contain hazardous chemicals or use them in their production process. Hazardous waste must be monitored and controlled from source to final disposal. Output can be reduced by not mixing hazardous and non-hazardous waste. But, again, the most effective solution is not to produce it in the first place.

Energy from waste

Rubbish can be burned in special incinerators using the resulting energy to produce steam for heating buildings or generating electricity. Many factories use this technique to cut waste output and generate some of the energy required for production processes (see paper factory on page 12). One tonne of rubbish produces as much heat energy as 250 kilograms of coal. The US now burns 15 percent of its solid waste – 14 percent in waste-to-energy plants and the rest in conventional incinerators. Burning waste substantially reduces the amount of trash going to landfill. But waste-to-energy plants cause air pollution. And some critics of such plants fear that burning waste will hamper recycling programmes.

Los Cartoneros, Buenos Aires' waste scavengers

The World Bank estimates that in low-income countries around the globe about two per cent of the population make a living by selling salvaged materials. Informal waste collection systems have many environmental and economic benefits, reducing the need for landfill, and saving energy and natural resources.

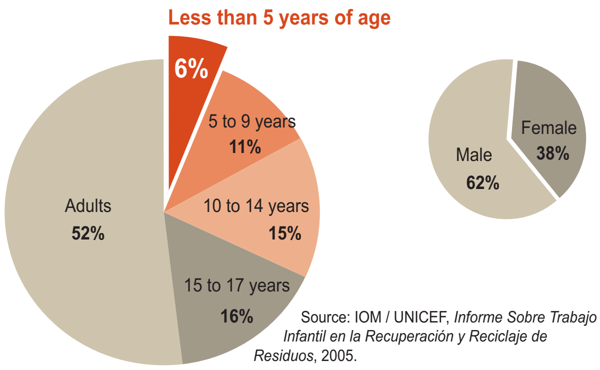
The number of waste scavengers depends on economic conditions, unemployment and city waste management policies. Waste recovery rates tend to reflect fluctuations in prices for recycled materials.

In Buenos Aires informal waste collectors recover 9 to 17 per cent of municipal waste, representing an estimated saving for the municipality of US$30 000 to US$70 000 a day or US$3.5 to US$7 per collector. Scavenger households earn an average of US$58.4 a week. Despite their role in the economy, the working conditions of Buenos Aires cartoneros and their counterparts in other cities in the developing world are very poor, working mainly at night, without any protection such as masks or gloves.

An IOM/UNICEF study estimates that children or teenagers account for roughly half the waste scavengers working in the Argentinian cities. It considered that Buenos Aires has some 8 800 cartoneros, 4 300 of whom are children or teenagers.

The study reveals that 90 per cent of minors working as collectors do it more than once a week, and for more than three hours a day. Their occupation raises several concerns for their well-being. They often suffer health problems due to poor living conditions and exposure to waste. Family income may be too low to pay school fees, pushing them into the streets at an early age. The low social status of scavengers discriminates against them and reduces their chances of social advancement.

Waste scavengers of Buenos Aires



Source: IOM / UNICEF, *Informe Sobre Trabajo Infantil en la Recuperación y Reciclaje de Residuos*, 2005.

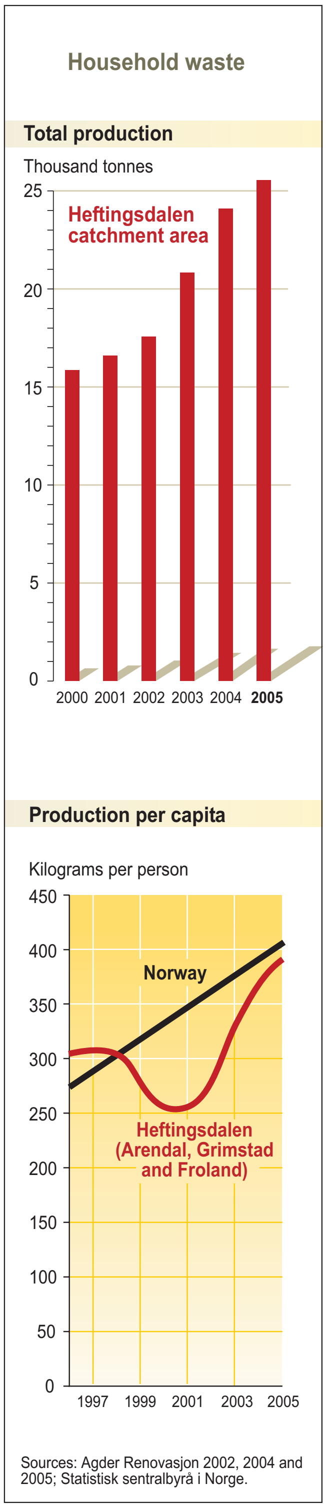
CASE STUDY FROM HEFTINGSDALEN, NORWAY

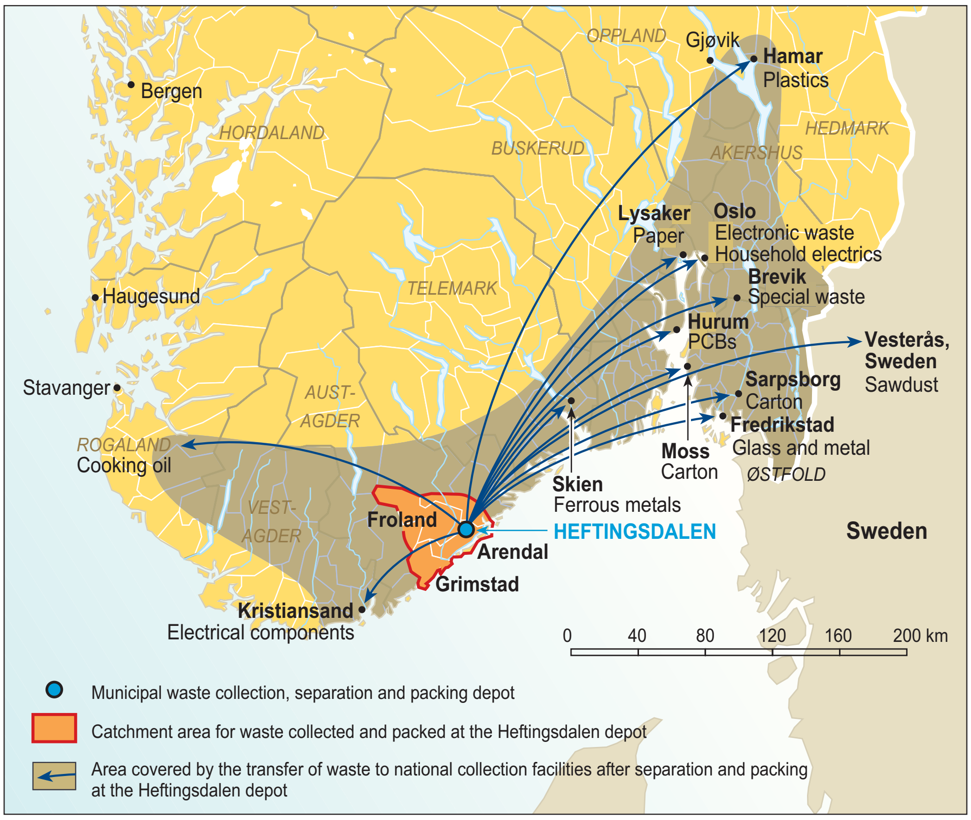
A model for waste processing?

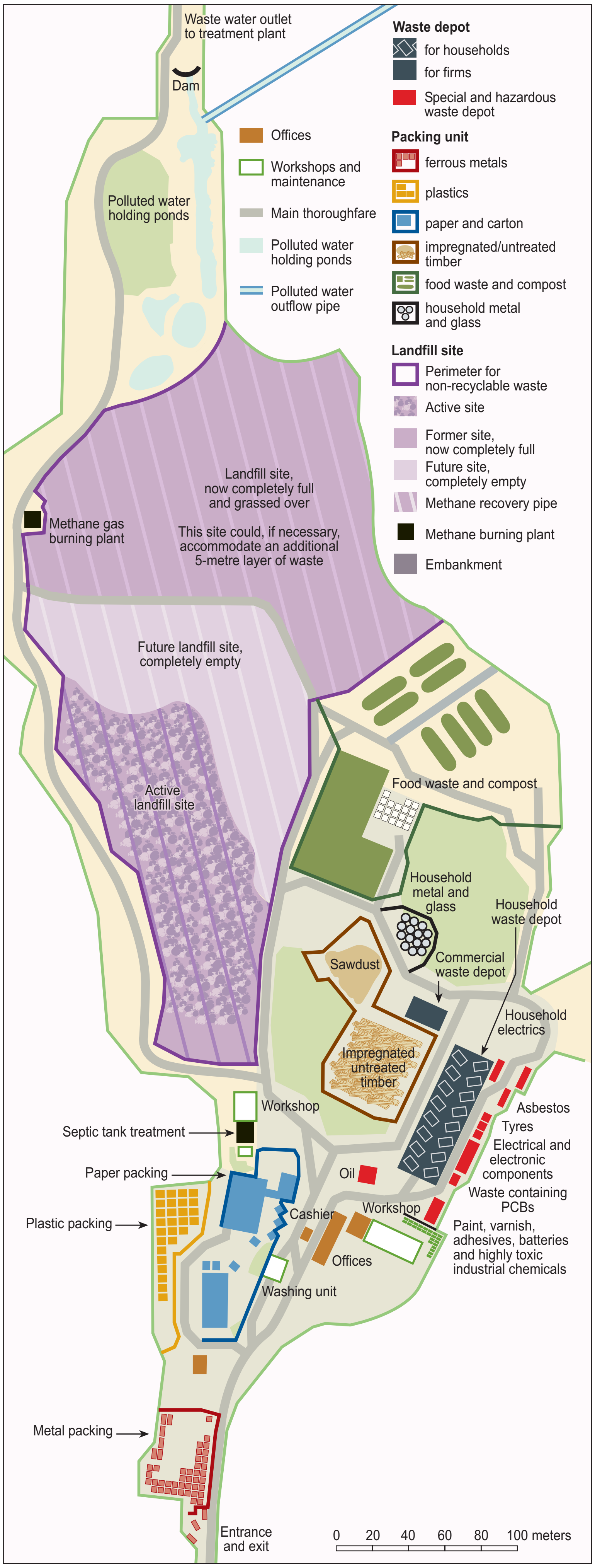
"Everything you see, any of the goods on the shelves, will all end up with us. It may take a day or ten years, but in the end we recover everything, even the contents of septic tanks." Our visit to the Heftingsdalen municipal waste processing plant (which serves three localities in southern Norway) starts in the supermarket of the nearby village of Saltrød!

"I wanted to remind you why places like Heftingsdalen exist. For consumers, waste disappears the moment their bin is emptied. They see us as a sort of cemetery for the consumer society. They completely disregard the concept of waste and what it becomes. Nor do they have much idea of the many ways waste may be processed. Nothing disappears. It all becomes something else, which inevitably impacts on our environment and way of life." Our host, an engineer, takes us past the shelves pointing out needlessly over-wrapped goods and packaging that mixes materials (carton and plastic, for instance), a nightmare for recycling. *"There are times I feel like a paramedic in a humanitarian crisis. We have this enormous ability to produce consumer goods, with a correspondingly huge flood of waste, which is stretching our limits. Five years ago waste processing plants represented a fairly effective, sustainable solution, now they are a crisis response."* In 2005 household waste output was up by 10 000 tonnes on 2000, rising from 15 000 to 25 000 tonnes for almost the same population. Nor does this include 20 000 tonnes of business waste (construction, light industry and service sector). In all Heftingsdalen processes about 45 000 tonnes of waste, making an average of 720 kilograms per person per year.

At the entrance to the plant, which covers more than 15 hectares, a sign announces: *"Compost, bark and wood shavings for sale"*. Other waste is separated, packed and redirected to logistics centres elsewhere in Norway and Sweden. Jens Christian Fjelldal, the head of the plant, explains that they sell a range of more than 200 recycled materials to buyers in Europe and even South America and Asia. The recycling activity pays its way, enabling the three localities to cover the full cost of waste management. The plant employs about 30 people and makes a tiny profit of about €500 000.







The plant is designed to restrict waste movement and environmental damage. Strict safety regulations govern storage of hazardous waste (chemicals, asbestos, varnish, oil, etc.). Such waste is not moved until it is destroyed on the spot or redirected to specialist plants elsewhere. All the other waste is separated by the consumers themselves and dumped into skips. Full skips are transported to the relevant processing plant in such a way as to restrict internal movement. Special drains collect any polluted surface water, contaminated with chemicals, germs or pesticides, and channel it to holding ponds. From there it flows down a closed pipeline to a waste water treatment plant 20 kilometres away. Waste effluents must never come into contact with the water table.

Much of the plant is devoted to composting and landfill for unseparated waste, the latter occupying half the total area. This is the destination of all the waste that can neither be separated nor recovered (37 per cent of the total). Every day bulldozers carefully spread 20 to 25 cubic metres of trash dumped by the refuse collection vehicles. The heaps of detritus are a stark reminder of the problem of over-consumption and waste. The area allocated to landfill is filling up much faster than in the gloomiest forecast. The current site has already reached the level originally planned for 2014. At this rate Heftingsdalen will soon be full, the only solution being to spill over into the surrounding forest. The plant could also obtain permission to raise the embankment making room for several tens of thousands more tonnes of waste, but that too is only a short-term solution.

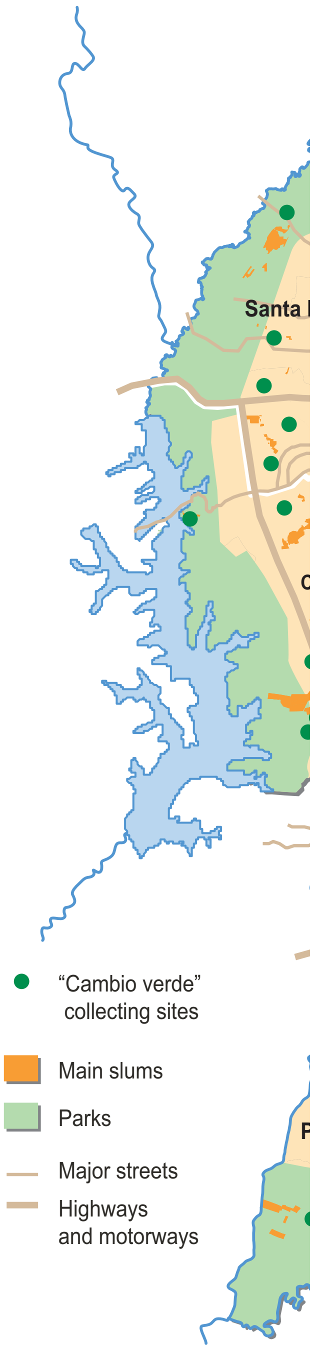
As it seems likely that the Norwegian authorities will introduce measures, coming into force in 2009, to ban landfill for unrecoverable household waste and switch to incineration, the team at the plant is looking at ways of recovering energy from waste incineration, a technology that is cheaper and more energy-efficient than the methane production plant previously considered. At present methane gas emissions are almost all burned in a furnace at one end of the site. In all some 1.9 million cubic metres of gas are burned every year to avoid releasing it into the atmosphere. The energy could however be put to other uses.

In terms of waste separation Heftingsdalen is exemplary, processing waste in ways that are safe for its workers and the environment. But it is just one small cog in a complex system, with energy consumed at every step in the recycling process, including transport and handling. If the ecological balance sheet includes energy costs the whole process proves pointless. It may save raw materials and protect nature, but oil consumption and emissions still increase. Plants such as Heftingsdalen only make sense if they go hand-in-hand with progress by all the players involved. Upstream, manufacturers need to rethink their choice of materials, to facilitate separation, with distributors redesigning packaging. Downstream, government and international agencies must restrict the movement of waste and promote the construction of local or regional processing plants.

CASE STUDIES FROM CURITIBA AND LONDON

Creative alternatives

Overcoming the broad challenges posed by household waste requires a holistic approach, both in well-organised Europe and North America as well as in other continents, where the problems are of a different nature. The two examples on this page demonstrate that by looking at waste in a broader context we may find solutions that solve more than one problem at a time. Whether imposed from above as in the Brazilian city of Curitiba or as part of a private initiative at Beddington, in the suburbs of south London, the results are encouraging and provide a blueprint for the future.



ON THE WEB

BedZED: *www.bioregional.com*
Curitiba: *ippucnet.ippuc.org.br/Bancodedados/Curitibaemdados/Curitiba_em_dados_Pesquisa.asp*
www.curitiba.pr.gov.br
Ecological housing in Europe: *www.oneplanetliving.org*

BedZED: Make use of waste, don't create it

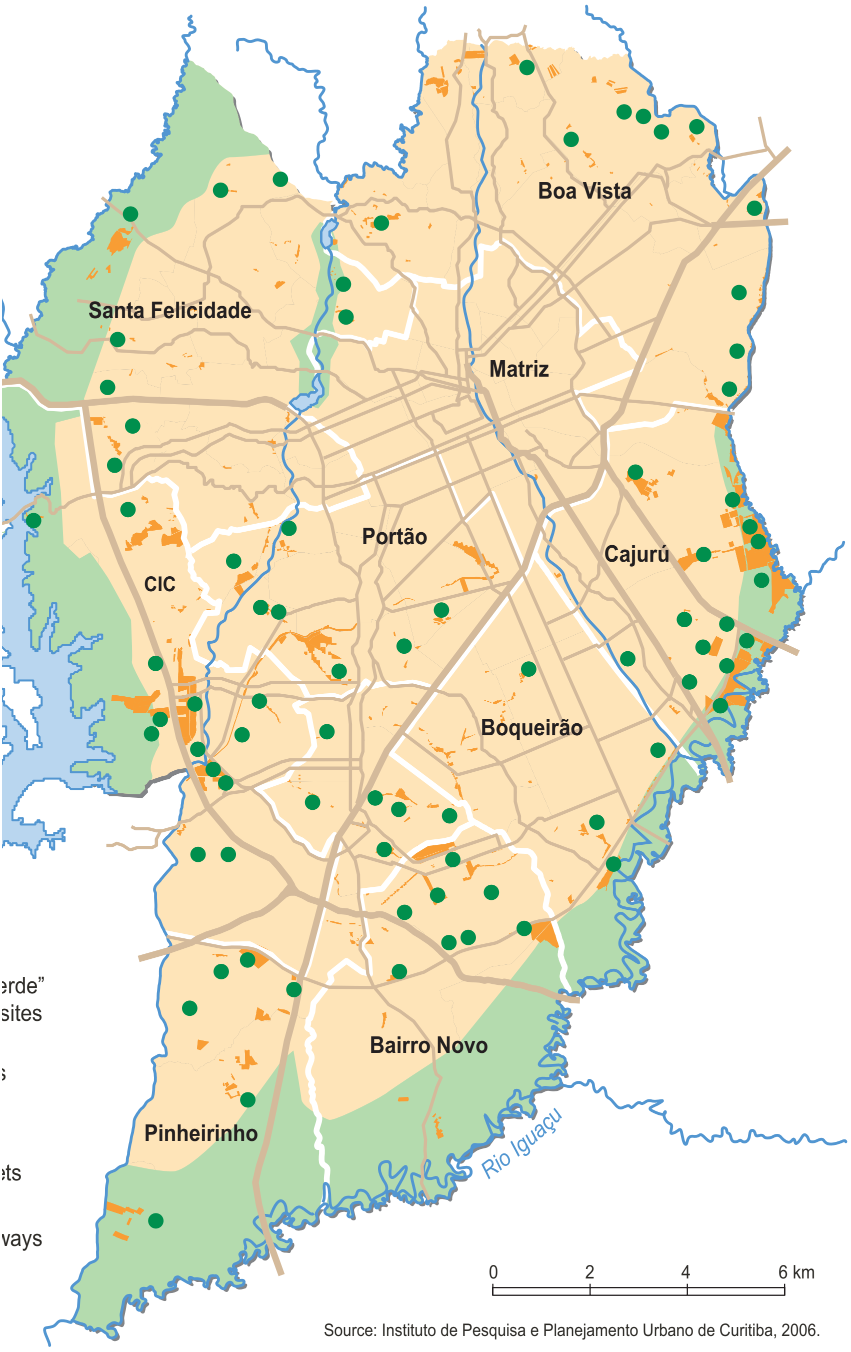
At Beddington, south of London, a housing development known as BedZED (Beddington Zero energy development) was designed from the start to produce little waste of any sort. It was built on a depolluted plot of land, previously used by industry, and recycled materials were used in its construction. For instance 120 tonnes of steel girders were recovered from demolition sites and reused. BedZED's inhabitants are sparing in their use of private transport and sort their household waste, composting anything organic. The architects also took considerable trouble to restrict use of water and liquid effluents as a whole.

An average British consumer draws more than 150 litres of mains water a day, whereas their BedZED counterpart makes do with 76 litres, halving the amount of waste water that needs to be processed. To achieve this result all the taps at BedZED are fitted with energy-saving systems. Conventional flush toilets account for a third of the water used by households, drawing 7.5 to 9 litres of water each time. BedZED toilets are fitted with a dual-flush which uses 2 or 4 litres. This results in an annual saving of 11 000 litres per person. Similarly a clothes washer uses about 100 litres on average for each wash, engulfing 21% of all the water consumed by UK households. Washing machines at BedZED only require 39 litres, achieving annual savings of 16 700 litres per household.

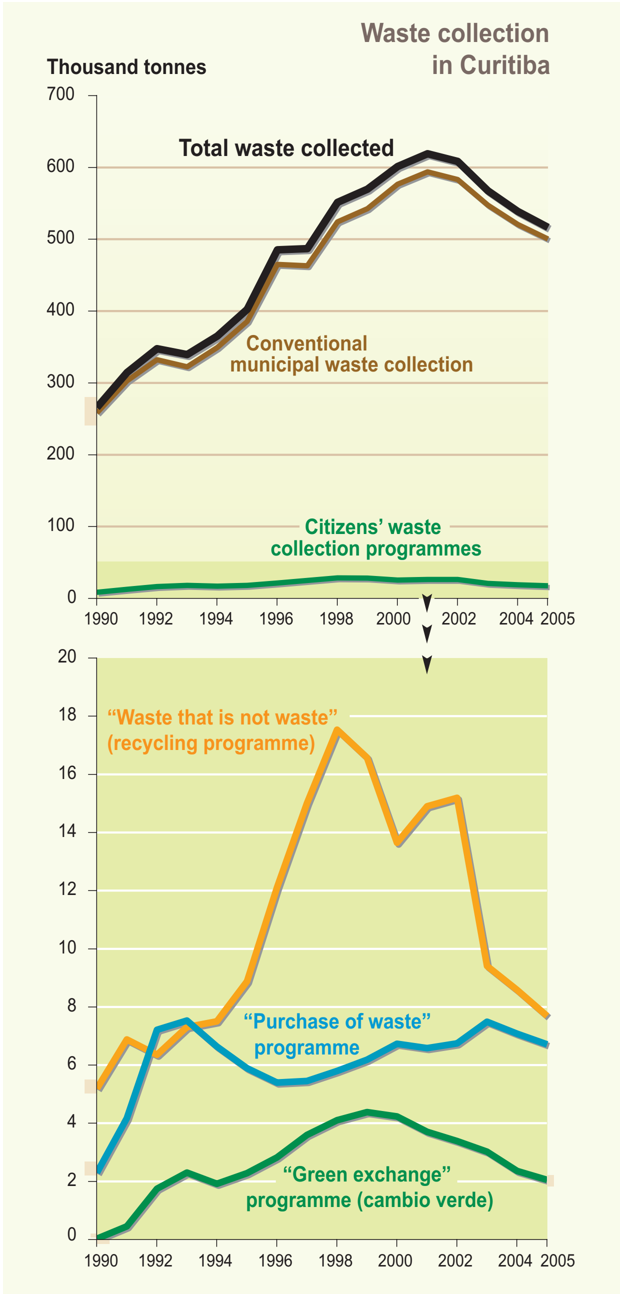
The housing development also makes good use of any rain, with 328 square metres of planted roof space and 2 000 square metres of untarmacked land, both of which soak up rainfall. Rain falling on the remaining 472 square metres of roof space is channelled into huge tanks, subsequently used to water gardens and flush toilets. Other vegetation processes waste water organically for reuse in the toilets. Simply by not tarmacking outside areas waste water flowing into the sewage system is reduced by 1 540 cubic metres a year.

BedZED, launched in 2002, is the largest environmentally friendly housing development in the UK. With about 100 privately owned or rented flats and offices it uses no fossil fuels, operating without central heating. Energy saving is built-in and flats only require about 10 per cent of the energy used by even the most recently built conventional housing. The rest comes from solar radiation, heat produced by household devices (or computers in the offices) and the body temperature of occupants.

Comparable developments already exist or are being designed elsewhere in Europe, and further afield, mainly at the initiative of individuals or groups keen to minimise the environmental impact of their lifestyle.



Source: Instituto de Pesquisa e Planejamento Urbano de Curitiba, 2006.



Curitiba: smart policy for a green identity

Curitiba has become world-famous for its original approach to basic municipal problems thanks to a unique mixture of innovative town planning, determined political leadership and good public relations.

In the 1980s severe hygienic problems plagued parts of Curitiba where housing development was uncontrolled. The winding streets were too narrow for council trucks and waste rotting in the open caused disease. In 1989 the council decided to act. It sent environmental education teams into affected areas where they joined forces with neighbourhood associations to organise waste collection by local people. These groups took charge of distributing rubbish bags to inhabitants and put big containers where the waste-collection trucks could reach them. Villagers bring the waste they collect to the containers. Neighbourhood associations pay the collectors and in turn receive payment for the waste collected from the bins. Initially an eight to ten kilogram bag earned a ticket for public transport or school equipment. Later it changed to a bag of fresh farm produce, of which there is a local surplus. One to four bags entitled collectors to a limited choice of produce, and in exchange for more than five bags there is rice, potatoes and honey too. Ten per cent of the value of recycled waste is paid to the association, with members deciding which community projects qualify for investments.

With the "purchase of waste" and "green exchange" programmes, the municipality achieves several aims in one go: hygiene among the poorest inhabitants is improving, as is their diet; people now have a paid occupation; and there is less waste littering the streets of Curitiba.

Also in 1989 the whole city of Curitiba started separating different categories of waste and recycling it. The motivation was an overflowing landfill. But the programme had a social goal too: by recycling precious materials it created work.

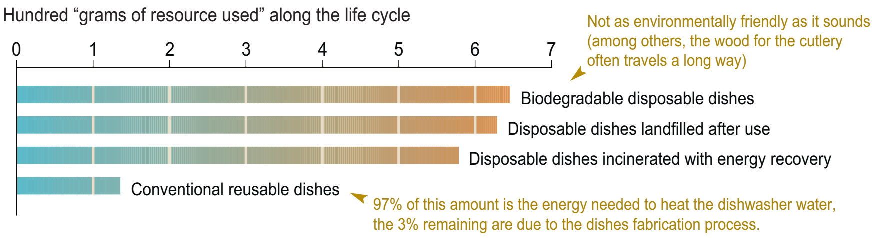
Curitiba had the good sense to combine goals of different departments and bring international publicity to political and managerial decisions. It has thus won renown worldwide while raising the environmental awareness of its townspeople, who are proud of their surroundings and keen to keep them clean.

Recycling – the right choice?

Reusing and recycling are natural survival strategies for many people in the developing world. In rich countries we abandoned the habit and are now re-learning how to reuse and recycle. Public rubbish collection and a well established recycling industry do a big part of the job for us. We appease our guilty conscience by recycling the goods we buy in increasing amounts. But recyclers do not process everything locally, sending some devices abroad for reuse by those who cannot buy new goods. There they pile up. But this does not mean we should stop recycling waste. We just have to keep sight of what it involves.

Recycling demands lengthy transport, which also affects the environment. In France waste transport accounts for 15 per cent of all goods transport. It is estimated that half the cost of recycling a tonne of waste is transport-related. It has an impact on energy consumption too. Much glass is recycled but its recovery, involving transport and melting, consumes lots of energy. Why not reuse the same bottles several times? So if we really want to reduce damage, the only solution is to cut waste output. The simplest way to do that is to reduce consumption. Hence the three “Rs” slogan: reduce – reuse – recycle. We might add, rethink!

Everyday alternatives: biodegradable, disposable or conventional tableware?



The calculations consider all resources necessary to support the life cycle of a single table setting (plate, glass, knife, fork, spoon and coffee cup).

Source: Friedrich Schmidt-Bleek et al., *Der ökologische rucksack, Wirtschaft für eine zukunft mit zukunft*, Hirzel Editions, Stuttgart, 2004.

The priority is to decrease the amount of waste we generate. Only then should we will be proud of the high rates for recycling some countries report (see examples for glass and paper). Glass recycling scores best, perhaps because an old habit has never been lost. Many countries still have a deposit on glass bottles (Scandinavia) or have even expanded it (Germany).

The downside of the mobile phone hype

On average Americans changes their mobile every two years. In Europe they only keep them 18 months. Yet the device itself is designed to last at least seven years. In the US, in 2005, an estimated 130 million cell phones were trashed, resulting in 65 000 tonnes of waste. Most of these ex-marvels of technology end up as toxic fumes and dioxin belching from an incinerator, due in particular to indium, a metal found in liquid-crystal displays. Only two per cent of mobiles are recycled in Europe. Millions of others are lying around unused in cupboards and drawers (19 million in France alone). And their number will go on rising until efficient recycling systems are set up.

Some operators recover old mobiles and send them to eastern Europe and emerging countries where they are reconditioned and sold. This “generous” gesture enables operators to displace future waste and build up a customer base in countries where wireless networks are developing. The collection of these used phones at the end of their life remain a challenge.

A French NGO has adopted a different approach. With the help of a welfare organisation it is refurbishing old phones and giving them to poor people in France, who feel excluded not having a mobile.

As for recycling itself, the cable on the charger, once crushed and sorted, produces copper and plastic. LCD screens are processed at special facilities, as are batteries which generally contain lithium. The shell is melted to make more plastic. Specialist recyclers can powder the integrated circuits and recover all the tiny quantities of rare, precious metals (gold, silver, copper, platinum, palladium, rhodium, etc.). With the price of raw materials rising steeply even such costly methods are becoming financially viable.

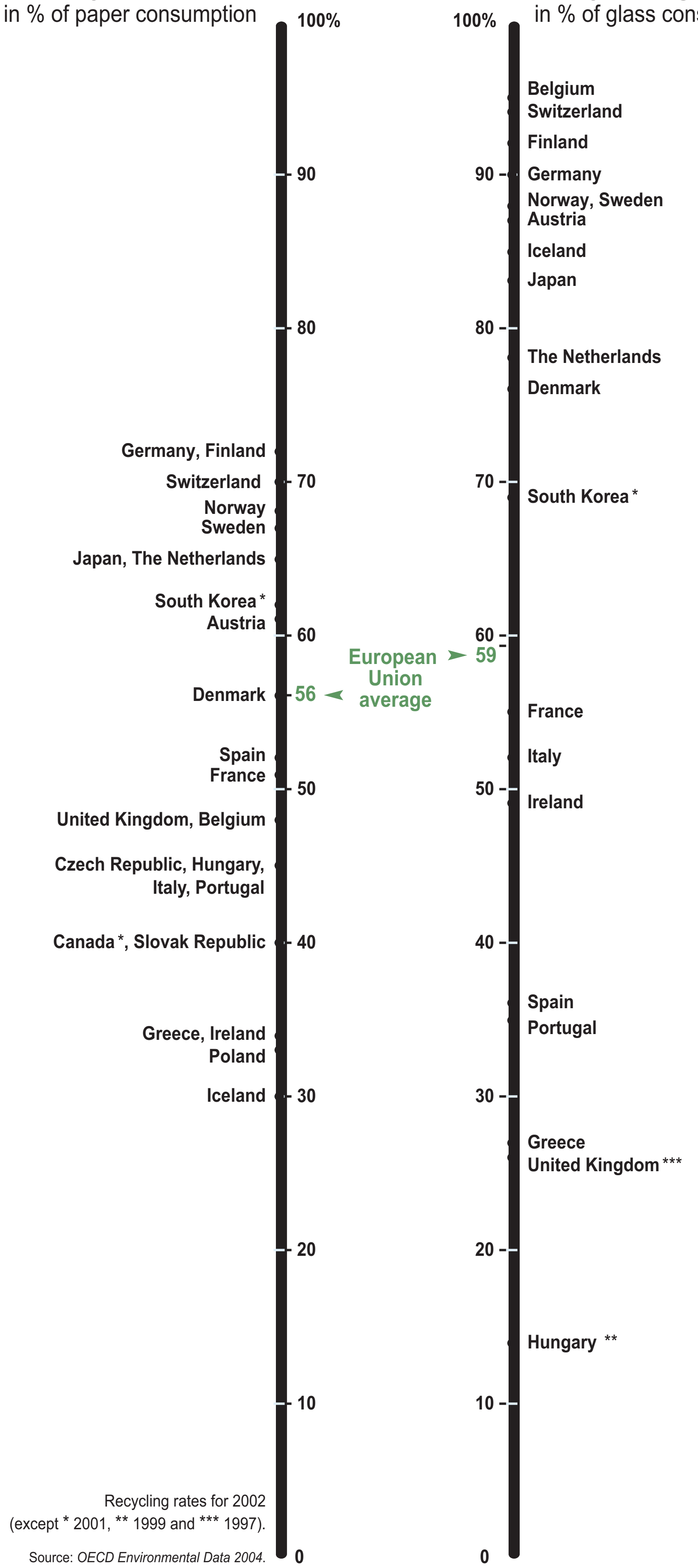
The waste caused by constant replacement of mobiles is certainly a problem. Yet we could halve that amount by simply keeping our phones twice or three times as long.

ON THE WEB

Local Paper for London:
www.greenchoices.org/features/00001.html
Mobile phone:
www.ticethic.com
Plastics:
www.residua.com

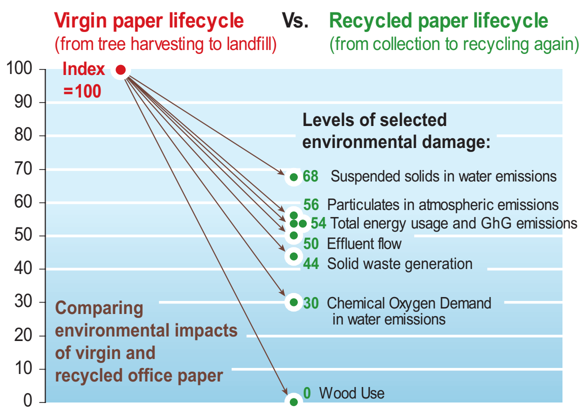
Recycled paper
in % of paper consumption

Recycled glass
in % of glass consumption



Recycling rates for 2002 (except * 2001, ** 1999 and *** 1997).

Source: *OECD Environmental Data 2004.*



Source: *Paper Task Force Recommendations for Purchasing and Using Environmentally Preferable Paper*, Environmental Defense Fund, 1995 (figures revised in 2002).

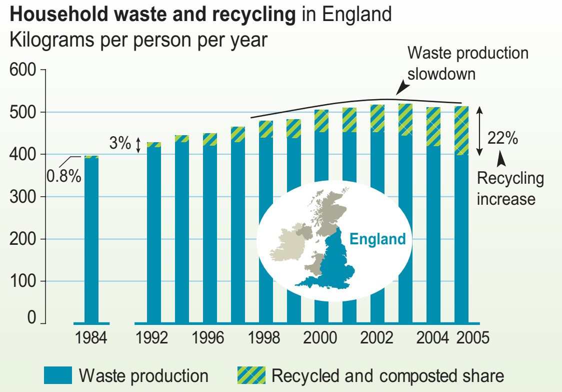
Other ways of recycling paper

In 1999, the British consultant BioRegional (see page 28) thought up an innovative way of dealing with waste paper. Surely offices could sort their own paper and, after local reprocessing, reuse it? Local Paper for London now recycles more than 2 000 tonnes of paper a year, cutting the paper bill by 20 per cent for 400 organisations (schools, government bodies, firms, etc.) taking part in the scheme.

Ugandans drive the Japanese way

As in other African countries there is a busy trade in second-hand cars from developed countries in Uganda. In 2002 it was estimated that the country imported 1 000 used cars, at least five years old, every month from Japan. More than three-quarters of them stayed in the capital Kampala.

Such imports have many environmental impacts, in particular on the atmosphere. Very few garages have the electronic gear to tune such cars properly. The ones that do are very expensive, the preserve of the upper classes and expatriate westerners.



Source: UK Department for Environment, Food & Rural Affairs / CIPFA.

Discarding mastodons

Bulky waste is a major challenge for the recycling industry, in no way comparable to everyday household waste. One comes in large, steady streams, the other is an occasional occurrence. We only replace mattresses, cupboards and fridges from time to time, whereas we empty the bin most days. In many countries local authorities organise special collection days. Residents may also take bulky items to waste collection centres. As a rule these centres are not open to industry, which must use professional services specialising in their particular type of waste (solid, liquid, chemical waste, etc.).

Hyperbulk waste, i.e. very large items, ranging from cars to boats and aircrafts, is a complex form of waste, containing large numbers of different components, some of which may be dangerous (batteries, asbestos, etc.). They must be dismantled with great care to ensure each waste category is processed separately and recovered. Separation demands expensive technical know-how. If we made allowance for dismantling at the design stage it would be easier and less expensive. Consequently hyperbulk waste is often sent from one country to another in order to find the cheapest dismantling facilities.

Jumbo recycling

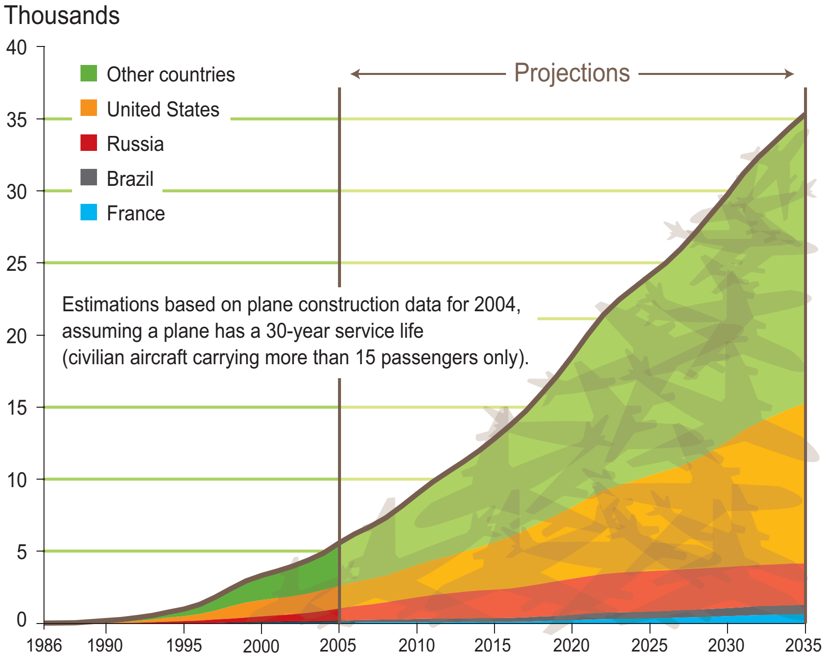
At the end of their service life airliners may prove useful in many ways. They often fly as freighters for several years. When finally grounded they are scavenged for spare parts for other aircrafts, or used for training aircrews and firefighters. Sometimes sheet metal is cut off and melted down. But many of them end up rusting at the end of an airstrip or in desert storage in Arizona, where US airlines have taken to dumping their old planes.

The first purpose-built recycling platforms are appearing in Europe and the US – Bartin Aero Recycling at Châteauroux-Déols airport in France, and the Evergreen Aircenter, at Marana, Arizona. At present they are processing planes built in the 1970s that have been in service for 30 years.

The recycling centres strip off any parts that can be sold (landing gear, instruments, etc.), "depollute" the aircraft (removing fuel, brake fluid, batteries, neon tubes, etc.) then cut it up. The scrap metal is ground up, automatically sorted by density and magnetism, then sold to the trade. It takes about two months to dismantle an aircraft.

Such platforms, when properly equipped, can recover the whole of a plane. The question is will they take the trouble to do so. There are 25 000 large civil aircraft (airliners, freighters and private jets) worldwide, with 7 or 8 000 of them probably being dismantled over the next 10 to 15 years. Furthermore the materials used to build planes are constantly changing. The airframe of the Airbus A380 contains 40 per cent composite materials, some of which are brand new, in particular Glare, a complex mixture of fibreglass and aluminium. Does anyone know how to recycle such materials? And what will happen to old aircraft stranded in developing countries, unable to reach a porperly operated recycling centre?

Number of planes to be dismantled worldwide

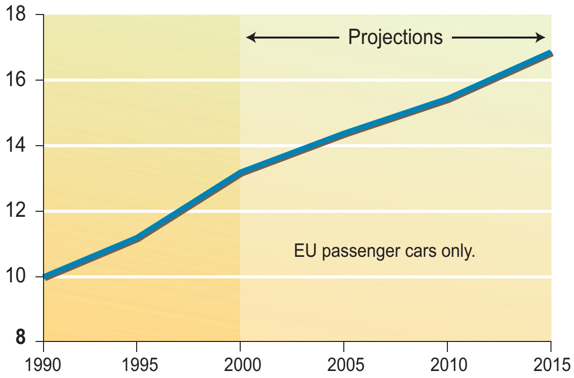


Sources: Institut du Transport Aérien; ENAC (French National School of Civil Aviation), 2006.

ON THE WEB

Aircraft Fleet recycling Association:
www.afraassociation.org
Greenpeace on shipbreaking:
www.greenpeaceweb.org/shipbreak

Number of cars to be scrapped in Europe
Millions



Source: Kilde, Larsen, 2000 as cited by the European Environment Agency.

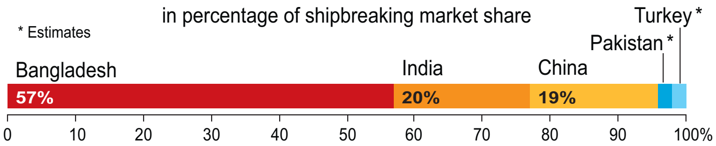
Scrapped cars or “end-of life vehicles” are not collected as bulky waste, but they too pose problems because of their size and disparate components. Given car production trends this is an issue that demands serious consideration.

Construction and demolition

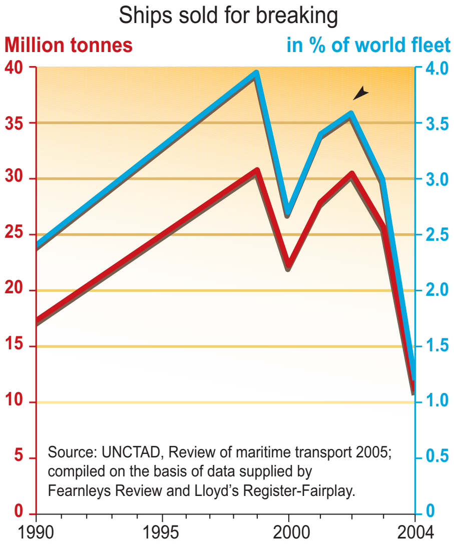
Building work is particularly common in emerging economies such as China, where skyscrapers are replacing entire traditional neighbourhoods, and places such as the United Arab Emirates, where the travel industry is booming, driving spectacular growth in the construction sector. In Abu Dhabi alone, the tourist board aims to develop about 100 new hotels over the next ten years. This is expected to cause a 25 per cent annual increase in building activity. Landfill in Abu Dhabi is already taking an estimated 800 tonnes of construction waste a day from the city and its surroundings.

In developed countries construction waste represents 10 to 15 per cent of total waste. Spain produces 35 million tonnes of building and demolition waste annually. Of that 25 million tonnes end up in uncontrolled tips and only 1 million tonnes are reused. This is all the more inexcusable now that we know how to crush and recycle concrete blocks, recover steel girders (see page 28 on BedZED), reuse bricks. If carried out systematically we could substantially reduce the environmental impact of building all over the world.

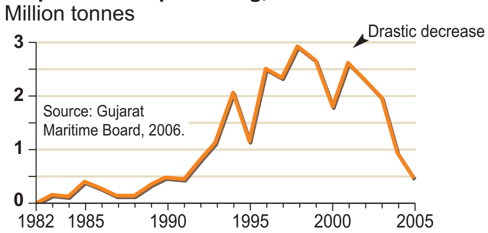
Shipbreakers of Asia



A few recent changes in national and international regulations provoked a massive drop in the tonnage of ships being broken up and major shifts in the shipbreaking market. Bangladeshi shipbreaking yards are, for example, gradually gaining ground on their Indian counterparts because Bangladesh does not enforce mandatory “gas-free for hot work” certification for oil tankers (Greenpeace).
In 2004 a Basel Convention decision officially classified old ships as “toxic waste”, preventing them from leaving a country without the permission of the importing state.



Ships broken up at Alang, India
Million tonnes



Official waste trade routes

Describing and quantifying global trade in waste is difficult. The official figures compiled by the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal are a good start, but have their limitations. Reporting is based on collaboration by member states and the Convention has no means of obliging any state to do so or of checking that data is complete. At present 99 countries monitor and publicise their imports and exports of 45 types of hazardous waste and two categories of waste "requiring special consideration" – household waste and their incineration residues. (Radioactive waste is not covered by the Convention.) Of the 99 countries reporting in 2003, 62 reported on the amounts of hazardous wastes exported. In addition, 17 Parties stated that there was no export from their country. 79 countries reported on imports. Of these 79, 42 declared not to have imported any hazardous wastes, and 37 described the quantities. The limited availability of national reports can distort the interpretation of the official data sets.

Transboundary movements of waste among Parties to the Convention
Million tonnes

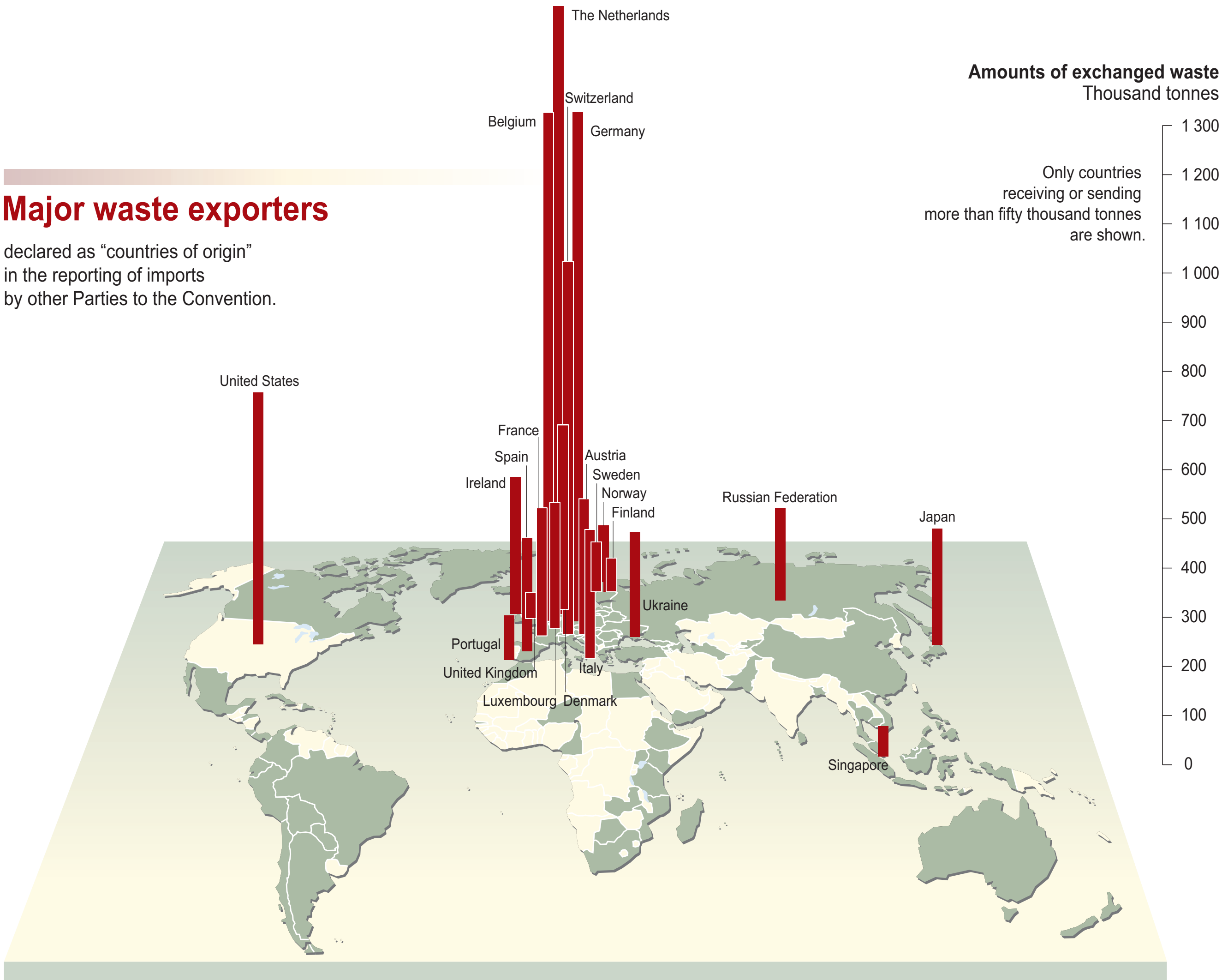
Basel Convention data trends

Looking at the Basel Convention datasets reveals several global patterns:

- The official trade in waste predominantly involves developed countries and official exports are not particularly directed towards developing countries. Although the BAN amendment that forbids trade from developed to developing countries (if both are Parties to the Convention) has not yet come into force, it is already implemented by the European Union.
- Incineration residues and lead compounds are among the most traded waste categories.
- Germany, Italy and France were the leading waste importers among Parties to the Convention in 2003.

Major waste exporters

declared as "countries of origin"
in the reporting of imports
by other Parties to the Convention.



Export for “Recycling” to the developing world

Exports of waste to the developing world are often labelled as “goods to be recycled”. In their destination countries, they nourish entire sectors of the local economy with the supply of scrap and dissasembled materials.

China is world’s biggest importer of waste and secondary raw materials, in 2004 the country imported more than 4 billion tonnes of plastics waste, around 12 billion tonnes of waste paper and over 10 billion tonnes of scrap iron and steel, according to a 2005 Japanese study.

Germany, a leader in the waste treatment industry?

Ninety-eight per cent of wastes entering Germany originate in Western Europe. German industry seems to specialise – among others – in processing residues from industrial waste disposal operations, zinc compounds and incineration residues. The availability of specific technologies for managing waste streams in a particular country may explain much of the trade described in the Basel datasets. There are only a few highly specialised processing units, on which specific waste streams must converge. At least part of the explanation why most of the reported waste movements concern OECD countries is that the processing units are often located there. Even though things are evolving quickly, most developing countries lack the infrastructure to support such technologies now.

ON THE WEB

Basel Convention datasets:
www.basel.int/natreporting/compilations.html

Transit and dispatching

Some countries, for example the Netherlands and Belgium, seem to act as “waste dispatchers”. Their figures suggest that they are the top waste exporters, a fact that reflects neither the waste they produce (given their population) nor their internal processing capacity. Presumably large amounts of hazardous waste are simply passing through Antwerp, Rotterdam and other industrial ports on the North Sea.

Rems on the road

Radioactive waste, outside the remit of the Basel Convention, is the Achilles’ heel of nuclear technology (together with power station safety). Its storage and treatment is a particularly complex issue and there are still only a few nuclear waste disposal facilities, many options having been ruled out on the grounds of geology or population. Radioactive waste may therefore travel some distance from production to storage sites. The French site at La Hague receives spent nuclear fuel from as far away as Japan. Special trucks regularly transport radioactive waste throughout Europe and Asia, causing lasting security problems. There has recently been renewed interest in international nuclear waste disposal sites, in particular Mayak in the Urals, in Russia. In the United States, the controversial Yucca Mountain repository in the Nevada desert is suggested to store all radioactive wastes of the country.

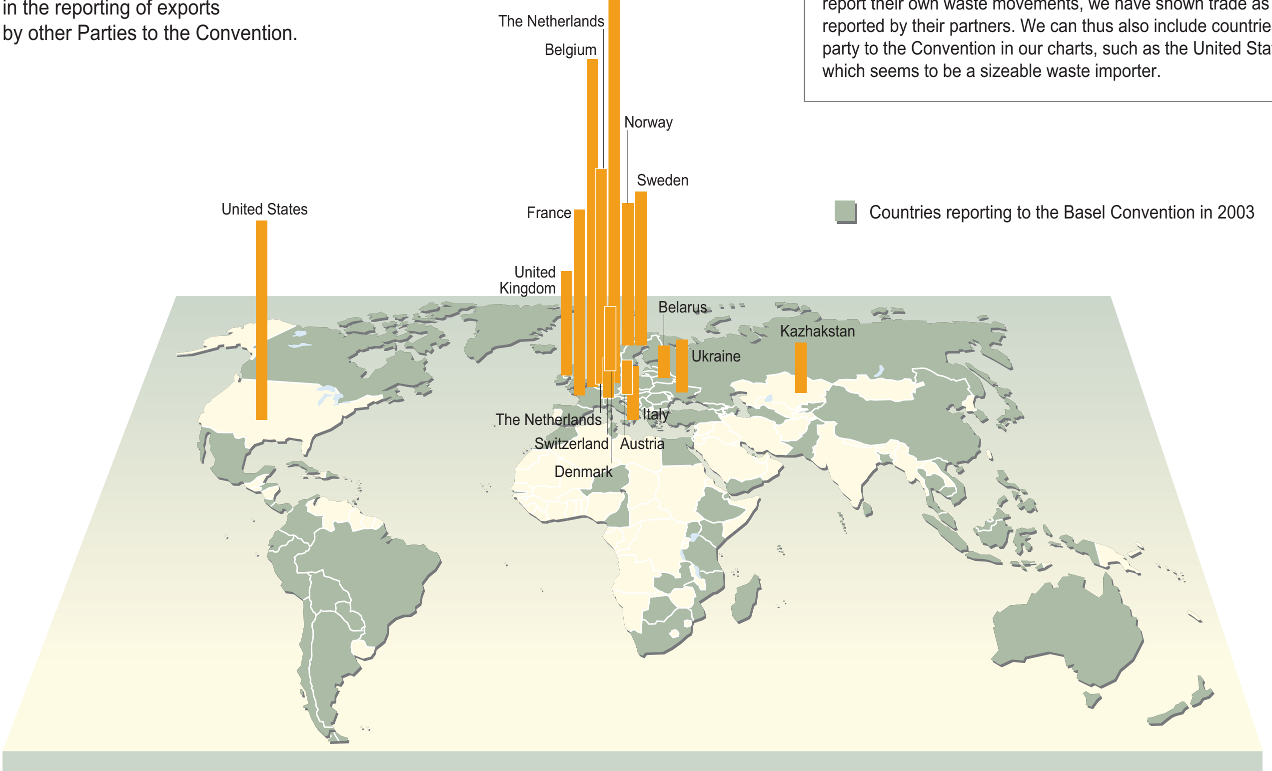
Major waste receivers

declared as “countries of destination”
in the reporting of exports
by other Parties to the Convention.

Source: Basel Convention, 2006 (data for 2003).

Caution: results may vary significantly between tables (reported imports or exports). This could be mainly due to some differences in classification of wastes and/or reporting of non-hazardous wastes. Germany, for instance, is reported as the destination of 4 150 thousand tonnes of waste by other member countries but only reports imports totalling 1 500 thousand tonnes.

Assuming that some Parties may consider it politically sensitive to report their own waste movements, we have shown trade as reported by their partners. We can thus also include countries not party to the Convention in our charts, such as the United States which seems to be a sizeable waste importer.



Crime industry diversifying

Despite international efforts to halt dumping of illegal waste outrageous incidents occur. Collating relevant data is difficult but there is no doubt about the damage. Toxic waste causes long-term poisoning of soil and water, affecting people's health and living conditions, sometimes irreversibly. It mainly involves slow processes that must be monitored for years to be detected and proven (let alone remedied).

Unscrupulous waste trade became a serious concern in the 1980s due to three converging factors: increasing amounts of hazardous waste; inadequate processing plants; and stricter regulations in the developed world with growing environmental awareness. Managing special waste streams properly became expensive, apparently too costly for some. Filthy shipments started travelling round the world.

Business as usual for (eco)mafia

All the investigations confirm that hazardous waste trafficking is booming. It is mainly the work of existing criminal organisations, using the same networks and methods as for other "goods", such as drugs, arms and people. They sometimes hide behind a legal front in the waste treatment industry. From emission to final disposal this trade involves many other players, including shipping agents and brokers. On the way waste may pass through several countries, making it all the more difficult to pinpoint responsibilities. The prime victims are developing countries (it is hard to refuse a large sum when your salary doesn't cover your living costs) and conflict zones (trafficking of all sorts thrives on social disorder).

In Italy an estimated 30% of the special waste processing business is thought to be owned by "ecomafia" outfits, winning contracts quite legally and "taking care" of waste by dumping it on the Campania Region farmlands or in the Mediterranean, in Italy and abroad (mainly in Africa). Legambiente, an Italian environmental NGO, estimates that eco-crime in Italy involves 202 organised groups, with €22.4 thousand million revenue in 2005. Though profit is the main incentive, the limited risks are also attractive. Environmental offences are not a priority and police pressure is consequently lower.

An international answer to global crime

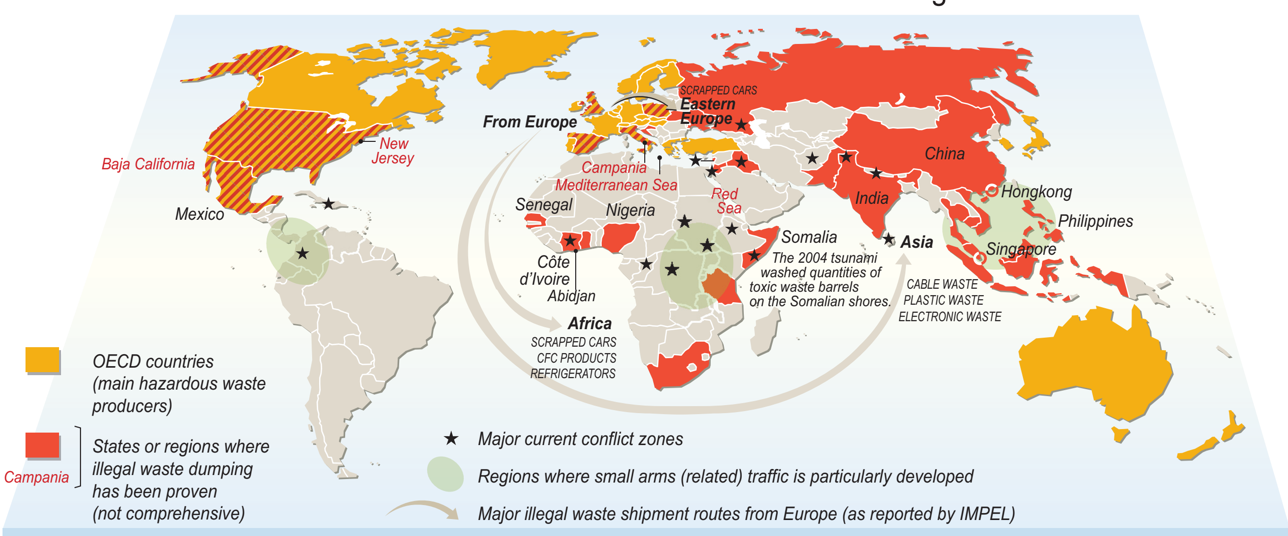
Combating waste trafficking demands international cooperation and a high-level of scientific expertise (to analyse the composition of waste, for instance). This is primarily the task of customs and port authorities, but initiatives for broader cooperation are developing, such as the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL), which controls shipments in major European ports. Waste being shipped is not necessarily hazardous and may consist of scrapped cars, old fridges, waste plastic (mostly going to Africa) and e-waste (mostly to Asia).

Fighting against illegal waste trade also requires harmonised environmental laws and the backing of an international jurisdiction, regardless of which territories or nationalities may be involved.

ON THE WEB

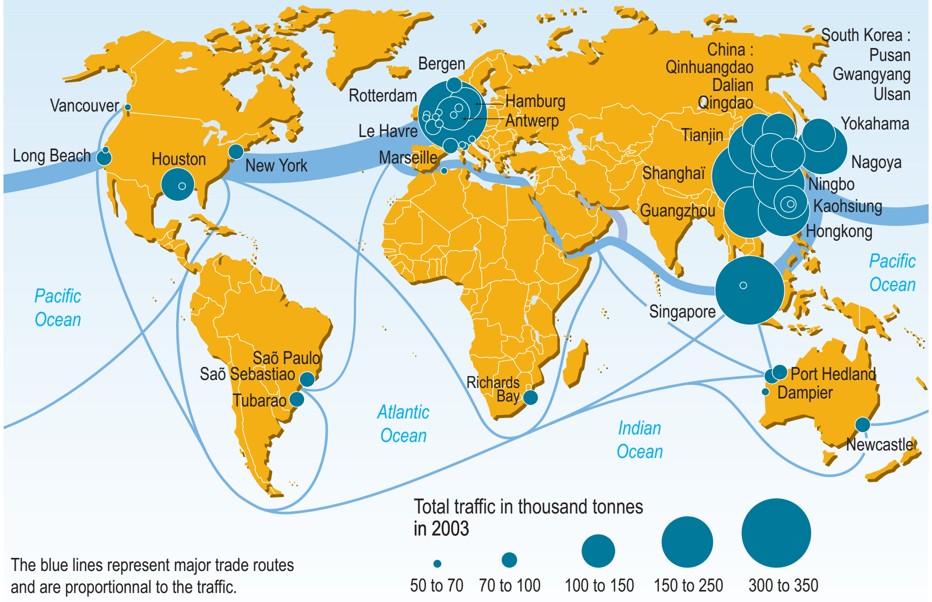
Basel Action Network:
www.ban.org
Iman Shebaro, Hazardous Waste Smuggling; A Study in Environmental Crime, TRACC:
www.american.edu/traccc/resources/publications/students/shebar01.pdf

Trafficking waste stories



Sources: Iman Shebaro, *Hazardous Waste Smuggling: A Study in Environmental Crime*, TRACC website; IMPEL-TFS Threat assessment project: *The illegal shipment of waste among IMPEL member states*, 2006; Legambiente; The Guardian, 14 October 2004; Human Rights Watch 1999 Report, *Human Rights, Justice and Toxic Waste in Cambodia*; Stockholm International Peace Research Institute, 2006; Small Arms Survey 2005.

Major merchandise ports [and likely waste transit points]



Sources: *Atlas du Monde Diplomatique 2006*, Armand Colin; *Panorama des ports de commerce mondiaux 2003*, ISEMAR, January 2005; *Images économiques du monde 2002*, Sedes.

The Abidjan disaster

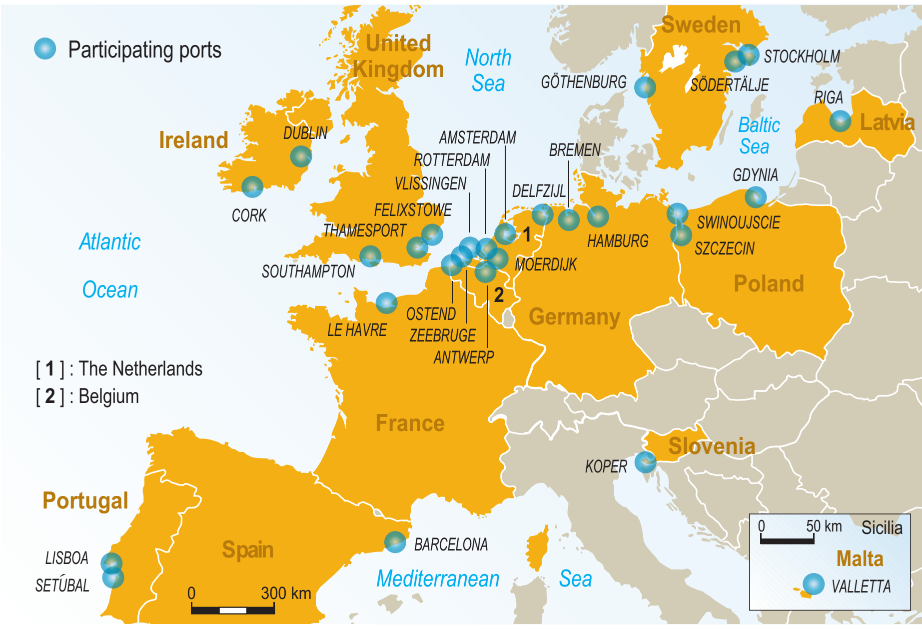
On 19 August 2006, highly toxic residues were dumped at over a dozen sites in and around the densely populated city of Abidjan in Côte d'Ivoire. At least 10 people were killed, many thousands became violently ill and half a million were forced to evacuate their homes in the following weeks.

Meanwhile, the hazardous residues have been recollected and will be incinerated in France, following emergency intervention by the United Nations. Investigators in several countries pursued several lines of investigation to determine what led to the tragedy. Was this a classic case of cross-border waste smuggling to avoid the regulations and high costs of waste disposal in developed countries? Or was it caused by the inadequate treatment of the "slops" left over after cleaning a ship's holding tanks?

Understanding the causes of such calamities is important for assigning liability. But it is also essential for gaining insights into how the illegal waste trade can operate. The ship that unloaded the toxic residues visited several other ports on its voyage to Abidjan, including The Hague, where it aborted an effort to dispose of wastes. Several months after the original dumping, it was still unclear whether the Basel Convention on hazardous wastes had been violated, or whether the the MARPOL Convention applies, which covers the treatment of post-voyage cleaning residues.

IMPEL Seaport project: a European initiative to control international waste shipments

Source: IMPEL-TFS Seaport Project II, *International cooperation in enforcement hitting illegal waste shipments*, 2006.



The making of international legislation

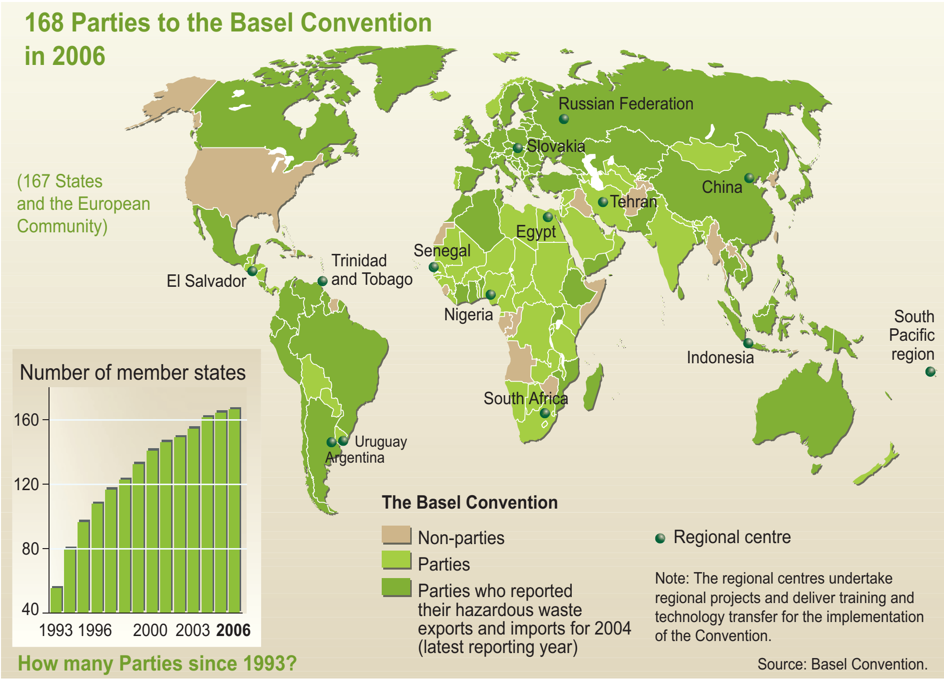
The cross-border transport of hazardous wastes seized the public's attention in the late 1980s. The misadventures of "toxic ships" such as the Karin B (1988) and the Pelicano, sailing from port to port trying to offload their poisonous cargoes, made front-page headlines around the world. These tragic incidents were motivated in good part by tighter environmental regulations in industrialized countries. As a consequence, the costs of waste disposal skyrocketed, and "toxic traders" searching for cheaper solutions started shipping hazardous wastes to Eastern Europe, Africa and other regions.

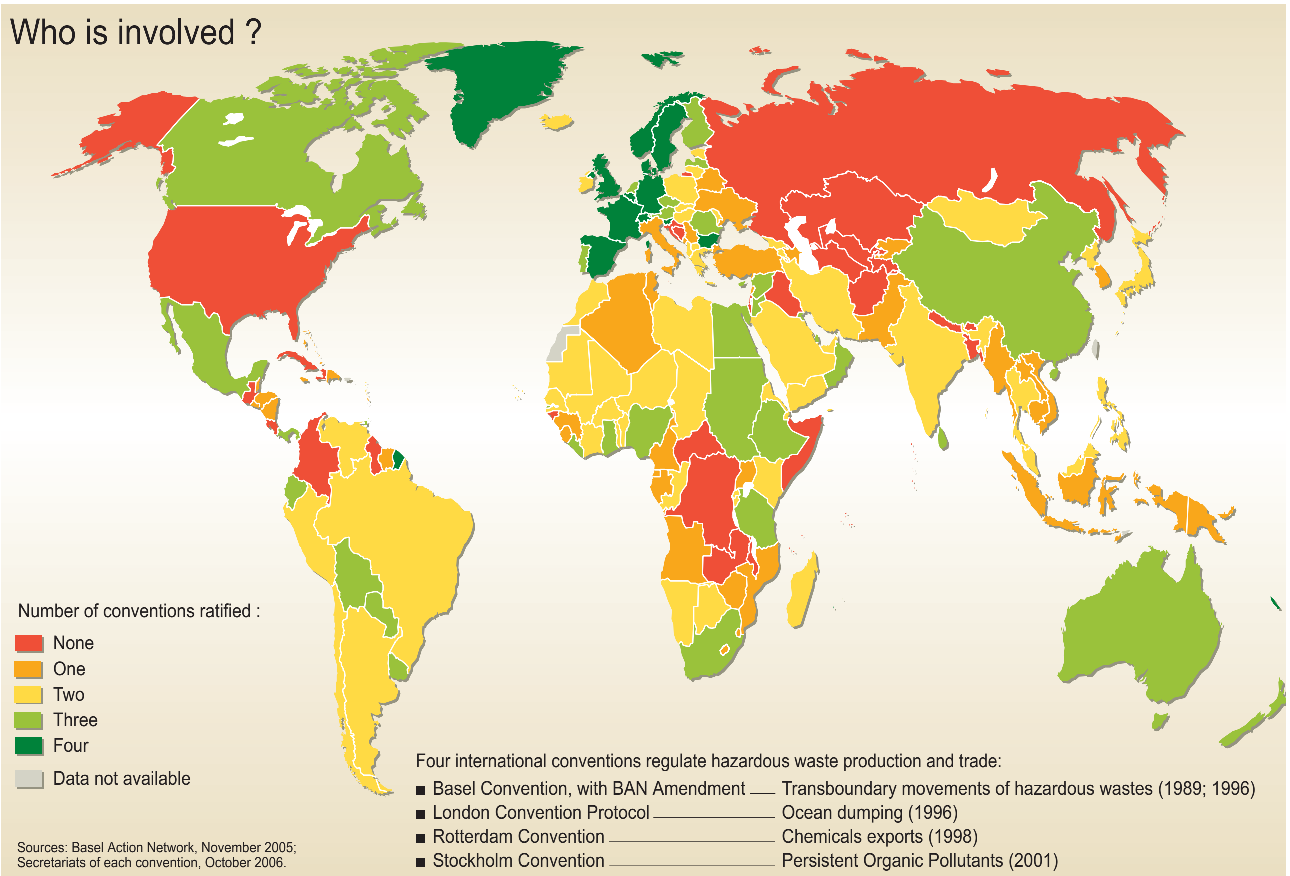
Recognizing that industrial society must fix this major flaw in the system, governments and many forward-looking companies started exploring solutions as early as the 1970s. The strong activism of civil society organizations and the interest of the media in cases of toxic waste dumping were central in bringing the issue on the international agenda. By the 1980s, the international community launched treaty negotiations under the auspices of the United Nations Environment Programme. In March 1989, they adopted the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. The treaty entered into force in 1992.

Following its adoption, many countries started discussions to address regional issues in more detail. Various protocols have been added to other conventions, among them to several UNEP Regional Seas Conventions aimed at protecting the marine environment from pollution from land-based sources, dumping of harmful substances and hazardous wastes, and protection from radioactive contamination.

Nongovernmental organizations are often at the root of new multilateral environmental legislation. They stir attention among the public and the media. Once the responsible governmental representatives have caught on, they collaborate with governments to initiate and shape conventions and protocols.

The most important other international conventions which address the production, transport or trade of hazardous materials and wastes are the London Convention, the Rotterdam and the Stockholm Conventions. They all address the same challenge: the most toxic chemical products of our industrial civilization must be carefully managed during their entire life-cycle from production to disposal. (see pages 40–41 for more on international waste treaties)


168 Parties to the Basel Convention in 2006
(167 States and the European Community)
Russian Federation
Slovakia
Tehran
China
Egypt
Senegal
Trinidad and Tobago
El Salvador
Nigeria
South Pacific region
Indonesia
South Africa
Uruguay
Argentina
Number of member states
160
120
80
40
1993 1996 2000 2003 2006
How many Parties since 1993?
The Basel Convention
Non-parties
Parties
Parties who reported their hazardous waste exports and imports for 2004 (latest reporting year)
Regional centre
Note: The regional centres undertake regional projects and deliver training and technology transfer for the implementation of the Convention.
Source: Basel Convention.


Who is involved ?
Number of conventions ratified :
None
One
Two
Three
Four
Data not available
Sources: Basel Action Network, November 2005; Secretariats of each convention, October 2006.
Four international conventions regulate hazardous waste production and trade:
■ Basel Convention, with BAN Amendment — Transboundary movements of hazardous wastes (1989; 1996)
■ London Convention Protocol — Ocean dumping (1996)
■ Rotterdam Convention — Chemicals exports (1998)
■ Stockholm Convention — Persistent Organic Pollutants (2001)

Defining and quantifying waste: a tricky undertaking

A multitude of approaches exists to classify the various categories of waste. Waste can be sorted either by its origin (what activity has created it?), by its composition (what is it made of?), by the level of danger it poses to humans and the environment, or by the way it is managed and treated. Each of these approaches will lead to a list of wastes, and often those definitions are overlapping – yet another fact that complicates the collection and interpretation of data about waste.

Examples of Definitions:

Waste according to

– the Basel Convention:

Wastes are substances or objects that have been disposed of, that are intended for disposal, or whose disposal is required by the provisions of national laws.

– the United Nations Statistics Division (UNSD):

Wastes are materials that are not primary products (produced for the market) and for which the generator has no further use in terms of production, transformation or consumption and therefore wants to dispose of. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded from this definition.

– the Organization for Economic Cooperation and Development (OECD):

Municipal waste is collected and treated by, or for, municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, yards and gardens, street sweepings, the contents of litter containers, and market cleansing. Waste from municipal sewage networks and treatment and from municipal construction and demolition is excluded.

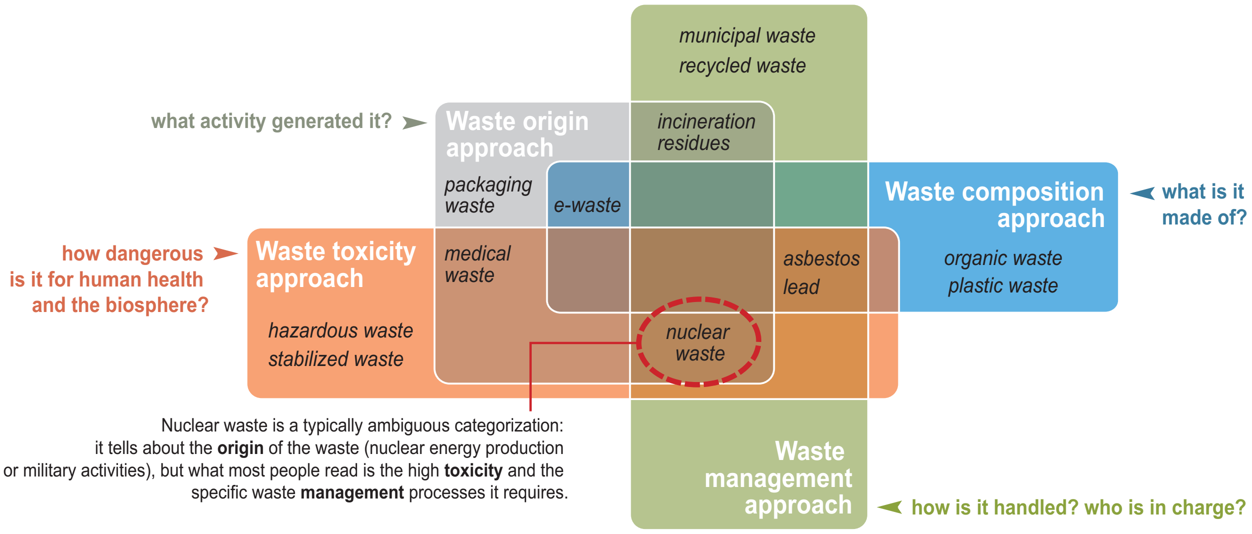
Hazardous waste is mostly generated by industrial activities based on specific patterns of production. It represents a major concern as it entails serious environmental risks if poorly managed. Environmental impacts mainly involve the toxic contamination of soil, water and air.

Nuclear (radioactive) waste is generated at various stages of the nuclear fuel cycle (uranium mining and milling, fuel enrichment, reactor operation, spent-fuel reprocessing). It also arises from decontamination and decommissioning of nuclear facilities and from other activities using isotopes, such as scientific research and medical activities.

About the difficulties of classifying waste (and counting it)

Different approaches and overlapping definitions

Statistical institutes of the world use various waste classifications, based on different approaches.
This diversity is the major obstacle to data globalization and comparison.



Nuclear waste is a typically ambiguous categorization: it tells about the **origin** of the waste (nuclear energy production or military activities), but what most people read is the high **toxicity** and the specific waste **management** processes it requires.

Some international hazardous waste legislation

The London Convention 1972 is an international treaty that limits the discharge of wastes that are generated on land and disposed of at sea. A so-called "black- and grey-list" approach is applied for wastes, which can be considered for disposal at sea according to the hazard they present to the environment. The 1996 Protocol is a separate agreement that modernised and updated the London Convention, following a detailed review that began in 1993. A "reverse list" approach is adopted, which implies that all dumping is prohibited unless explicitly permitted. The 1996 Protocol will eventually replace the London Convention.

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade is designed to promote shared responsibility and cooperative efforts among Parties on managing hazardous chemicals. The Parties have agreed to facilitate information exchange about the characteristics of hazardous chemicals and about their national decisions on importing and exporting hazardous chemicals. The Convention entered into force in 2004.

The Organization for Economic Cooperation and Development (OECD) has developed regulations for wastes intended for final disposal and recycling for further use. In 1992 it established a specific contron system for recyclables. The constituents of these lists have been amended several times.

In 1993, the European Community (EC) adopted its Directive 259/93 on the supervision and control of shipments of waste within, into and out of the EC. It implements the Basel Convention. Through its regulation 120/97 the EU implements the Ban Amendment of the Basel Convention. It also adopted several decisions on hazardous waste incineration and a waste framework directive.

The Stockholm Convention on Persistent Organic Pollutants (POPs) targets 12 major POPs for reduction and eventual elimination. The initial list includes PCBs, dioxins and furans, and DDT and other pesticides. The Convention also sets up a system for tackling additional chemicals that may be identified in the future as unacceptably hazardous. It recognizes that a special effort may sometimes be needed to phase out certain chemicals for certain uses. The Convention channels resources into cleaning up the existing stockpiles of POPs that litter the world's landscape. The Convention entered into force in 2004.

The Bamako Convention on the Ban of Import into Africa and the Control of Transboundary Movement of Hazardous Wastes within Africa includes radioactive waste in its definition and bans all import into Africa.

The Waigani Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region bans the "Importation into Forum Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes".

Protocols to several UNEP Regional Seas Conventions aim at protecting the marine environment from land-based sources of pollution, hazardous wastes and radioactive contamination.

The Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is the most comprehensive global environmental agreement on hazardous and other wastes. It aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes.

The Basel Convention regulates the transboundary movements of hazardous and other wastes and obliges its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner. The Convention covers toxic, poisonous, explosive, corrosive, flammable, ecotoxic and infectious wastes. Parties are also expected to minimize the quantities that are moved across borders, to treat and dispose of wastes as close as possible to their place of generation and to prevent or minimize the generation of wastes at source.

The Basel Convention has 14 Regional and Coordinating Centres (see page 38–39). The Centres develop and undertake regional projects, and deliver training and technical assistance for the implementation of the Convention under the direction of the Conference of the Parties and of the Secretariat of the Convention. The Basel Convention, adopted in 1989, came into force in 1992.

References

Selected books, reports, articles and on-line databases (in order of appearance):

Foreword

Paul Hawken, Amory B. Lovins, and L. Hunter Lovins (1999). *Natural Capitalism: Creating the Next Industrial Revolution*

European Commission Information Society and Media, Johanna Knast (2005). *Assessing Opportunities for ICT to Contribute to Sustainable Development*

8–9 Mining waste

Australian National Pollutant Inventory: www.npi.gov.au/

Carsten Sperling, Oekoinstitut e.V. (ed.) (1999). *Nachhaltige Stadtentwicklung beginnt im Quartier*. Freiburg

EC press release on mining waste: europa.eu.int/rapid/pressReleasesAction.do?reference=IP/03/784&format=HTML&aged=1&language=EN&guiLanguage=de

European Aluminium Association (EAA): www.eaa.net

Henrik Harjula, OECD (2006). Personal communication

The International Aluminium Institute: w ww.world-aluminium.org

UNEP, OSCE, UNDP, NATO (2005). *Mining for Closure – Policies, practices and guidelines for sustainable mining and closure of mines*

U.S. Geological Survey (2006). Bauxite and Alumina Statistics and Information: minerals.usgs.gov/minerals/pubs/commodity/bauxite

10–11 Energy production waste

UNEP, UNDP, OSCE, NATO (2005). *Environment and Security. Transforming Risks into Cooperation. Central Asia Ferghana/Osh/Khujand area*

International Atomic Energy Agency (2005). *Energy, Electricity and Nuclear Power Estimates for the Period up to 2030*. Reference Data Series No1

www-pub.iaea.org/MTCD/publications/PDF/RDS1-25_web.pdf

International Atomic Energy Agency (2005). *Energy indicators for sustainable development: guidelines and methodologies*. Vienna

International Energy Agency (2005). *Key World Energy Figures* www.iea.org/dbtw-wpd/Textbase/nppdf/free/2005/key2005.pdf

12–13 Manufacturing waste

Association of Cities and Regions for Recycling and sustainable Resource management (ACR+)(March 2006). powerpoint presentation: www.acrplus.org

Hawken and others (1999) (see foreword)

Paper:

Düsseldorf paper mill: www.schulte-papier.de

Food and Agricultural Organisation (2003). *Yearbook of Forest Products*

Invergordon paper mill: www.forscot.com

WWF Switzerland (2006). *Toilettenpapier und Walderhaltung. Eine Analyse des europäischen und Schweizer Hygienepapiermarktes,* assets.wwf.ch/downloads/06_02_20_tissue_studie_schweiz_final_web.pdf

14–17 Packaging waste

ADEME (2004). *Evaluation des impacts environnementaux des sacs de caisse Carrefour, Analyse du cycle de vie des sacs de caisse en plastique, papier et matériau biodegradable*. Report prepared for the French department store Carrefour

Environmental Defense Fund, 1995 (figures revised in 2002). *Paper Task Force Recommendations for Purchasing and Using Environmentally Preferable Paper*

European Environment Agency (2005). *Effectiveness of packaging waste management systems in selected countries: an EEA pilot study,* reports.eea.europa.eu/eea_report_2005_3/en/FINAL-3_05-Packaging_waste_WEB.pdf

18–21 Consumption

Adler E., Jeftic L. (2006). *Marine Litter – A Global Challenge*. UNEP paper produced for the Inchon ML workshop, May 2006

Cleaning wipes (in French): www.echo-nature.com/inf/actu.cgi?id=2077

Global Footprint Network: www.footprintnetwork.org

Key statistics from the International Telecommunication Union: www.itu.int/ITU-D/ict/statistics

Population and development in the United Nations system: www.un.org/esa/population

Sustainable consumption (in French): www2.ademe.fr/servlet/getDoc?id=11433&m=3cid=96

22–23 Household waste

Associates of Regional Planners and Architects – Kyoto (1998). *Detailed Sorting and Measuring of Household Waste*. Kyoto

French Agency of the Environment and Energy Management Ademe (2006). Virtual exhibition on the history of waste management (in French). www.ademe.fr/particuliers/expositions/dechet.html

Kohei Watanabe (2005). Reference material provided for the talk "Waste and Sustainable Consumption", Capability and Sustainability Centre, St Edmund's College Cambridge

E-waste:

DEWA/GRID-Europe (2005). *E-waste, the hidden side of IT equipment's manufacturing and use*, UNEP-Early Warning on Emerging Envrionmental Threats no 5. Geneva

Greenpeace International (2005). *Toxic tech. Pulling the plug on dirty electronics*. www.greenpeace.org/raw/content/italy/ufficiostampa/rapporti/rifiuti-tecnologici.pdf

Swiss Environment Agency information website on e-waste: www.ewaste.ch/welcome/ewaste_definition

24–25 Waste management

Gisèle Madeleine Thiombiano (2006). *L'Experience de L'ong Lvia dans le Secteur de la Gestion de l'Environnement Urbain au Senegal (1996-2005)*, (waste management and plastic recycling issues)

The White House Task Force on Recycling (1998). *Recycling ... for the future: Consider the benefits.* Office of the Federal Environmental Executive, Washington, DC

Waste to energy:

www.wte.org/environment/#

Waste scavengers:

IOM/UNICEF (2005). *Informe Sobre Trabajo Infantil en la Recuperación y Reciclaje de Residuos*

Medina M. (1999). *Reciclaje de Desechos Sólidos en América Latina*. In: Frontera Norte, Vol. 11, n° 21

WASTE advisers on urban environment and development. Thematic Evaluation on child labour in scavenging Africa, Asia and Europe: www.waste.nl/page/720

26–27 Case studies waste management

Curitiba municipality official websites: www.curitiba.pr.gov.br/Servicos/MeioAmbiente/ and www.curitiba.pr.gov.br/Secretatria.aspx?o=5

Database of the Institut of Urban Research and Planning, Curitiba: ippucnet.ippuc.org.br/Bancodedados/Curitibaemdados/Curitiba_em_dados_Pesquisa.asp

Marcio de Oliveira (1998). *Les Politiques Environnementales en milieu urbain: Curitiba* (Brésil)

BedZED:

Nicole Lazarus, BioRegional Development Group (2003). *Beddington Zero (Fossil) Energy Development, Toolkit for Carbon Neutral Developments* – Part II

30–31 Reuse/Recycling

Friedrich Schmidt-Bleek (ed.) (2004). *Der ökologische Rucksack, Wirtschaft für eine Zukunft mit Zukunft*. Hirzel, Stuttgart.

Greenpeace Research Laboratories (K. Brigden, I. Labunska, D. Santillo, & M. Allsopp, Department of Biological Sciences, University of Exeter, UK) (2005). *Recycling of electronic wastes in China & India: workplace & environmental contamination*, Greenpeace International report

Recyclage Récupération, 17 March 2006

32–33 Hyperbulk waste

Abu Dhabi Environment Agency (2006). *State of Environment Report. Sector paper Population and Economic Growth*. Unpublished draft version

Afra, Aircraft Fleet Recycling Association: www.afraassociation.org

Air et Cosmos, hors série n.7 spécial Airbus A 380

Bartin Aéro Recycling: www.bartingroup.fr/frameset.htm

Basel Action Network on behalf of the Global NGO Platform on Shipbreaking (2006). *Critique of draft I.M.O. "International convention for safe and environmentally sound recycling of ships"*. www.greenpeaceweb.org/shipbreak/IMO_Draft_Convention_CritiqueFINAL.pdf

Greenpeace International (2006). *Recycling of Ships, The need to develop a new legally-binding instrument that will build and improve upon existing environmental justice legislation*. Document submitted to the International Maritime Organization's Marine Environment Protection Committee 54th session: www.greenpeaceweb.org/shipbreak/MEPC54.pdf

Martin Messonnier, Frederic Loore, Roger Trilling (2001). *Uranium appauvri la guerre invisible.* Éditions Robert Laffont, Paris

34–35 Travelling waste

Secretariat of the Basel Convention (2005). Latest national reporting data: www.basel.int/natreporting/compilations.html

China waste import data: Michikazu Kojima (ed.) (2005). *International Trade of Recyclable Resources in Asia*, Institute of developing economies, Japan

36–37 Illicit waste trade

Apogee Research, Inc. (1996) *Transboundary Trade in Potentially Hazardous Substances,* Draft Technical Support Document.

Basel Action Network: www.ban.org

Block, Alan A. and Frank R. Scarpitti (1985). *Poisoning for Profit: The Mafia and Toxic Waste in America*. New York: William Morrow and Company, Inc.

Cass, Valerie J. (1996). *Toxic Tragedy: Illegal Hazardous Waste Dumping in Mexico*. In *Environmental Crime and Criminality,* ed. Sally M. Edwards, Terry D. Edwards, and Charles B. Fields, 99-119. Garland Publishing, Inc., New York

Center for Investigative Reporting and Bill Moyers (1990). *Global Dumping Ground: The International Traffic in Hazardous Waste*. Washington: Seven Locks Press

Clapp, Jennifer (1999). *The Illicit Trade in Hazardous Wastes and CFCs: International Responses to Environmental 'Bads.'* In: The Illicit Global Economy & State Power, ed. H. Richard Friman and Peter Andreas, 91-123. Rowman & Littlefield Publishers Inc., Lanham.

Hilz, Christoph (1992). *The International Toxic Waste Trade*. Van Nostrand, New York

Human Rights Watch (1999). *Toxic Justice: Human Rights, Justice and Toxic Waste in Cambodia*.

Iman Shebaro (2004). *Hazardous Waste Smuggling: A Study in Environmental Crime*. www.american.edu/traccc/resources/publications/students/shebar01.pdf

IMPEL-TFS Seaport project II (September 2004-May 2006). *International cooperation in enforcement hitting illegal waste shipments*. Project report

Legambiente, Gruppo Abele-Nomos, GEPEC-EC (2003). *The illegal trafficking in hazardous waste in Italy and Spain*, Final Report

The Jill Dando Institute of Crime Science, University College London, Environment Agency England and Wales (2005). *IMPEL-TFS Threat Assessment project: the illegal shipment of waste among IMPEL member states*. Project report

Transnational Crime and Corruption Center (TraCCC): www.american.edu/traccc

United Nations Disaster Assessment & Coordination (UNDAC) (11-19 September 2006), *Cote d'Ivoire Urban Hazardous Waste Dumping*

40–41 Waste definitions

Official Journal of the European Communities. List of Wastes established by the Commission Decision 2000/532/EC of 3 May 2000, amended in January 2001: europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_047/l_04720010216en00010031.pdf

Mobile phones

Article about coltan mining for mobile phones: www.alternet.org/stories/41477/

Basel Action Network (BAN) (2004). *Mobile Toxic Waste:* www.ban.org/Library/mobilephonetoxicityrep.pdf

TicEthic: specialists in digital recycling (in French): www.ticethic.com

Mobile phone re-use and recycling (private company): www.fonebak.com

General references

European Topic Centre on Waste and Material Flows: waste.eionet.europa.eu/wastebase

EUROSTAT (2005). *Waste generated and treated in Europe, data 1995-2003,* detailed tables

Organisation for Economic Cooperation and Development (OECD) (2005). *Environmental Compendium 2005*

UNEP/The Basel Convention/GRID-Arendal/DEWA-Europe (2004). *Vital Waste Graphics*

The Worldwatch Institute (2006). *Vital Signs 2006–2007, the trends that are shaping our Future*

List of maps and graphics

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Ferrous metal 3%
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SCRAPPED CARS
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