



Kiev report:

Final Draft Chapter: 7. Waste Generation and Management

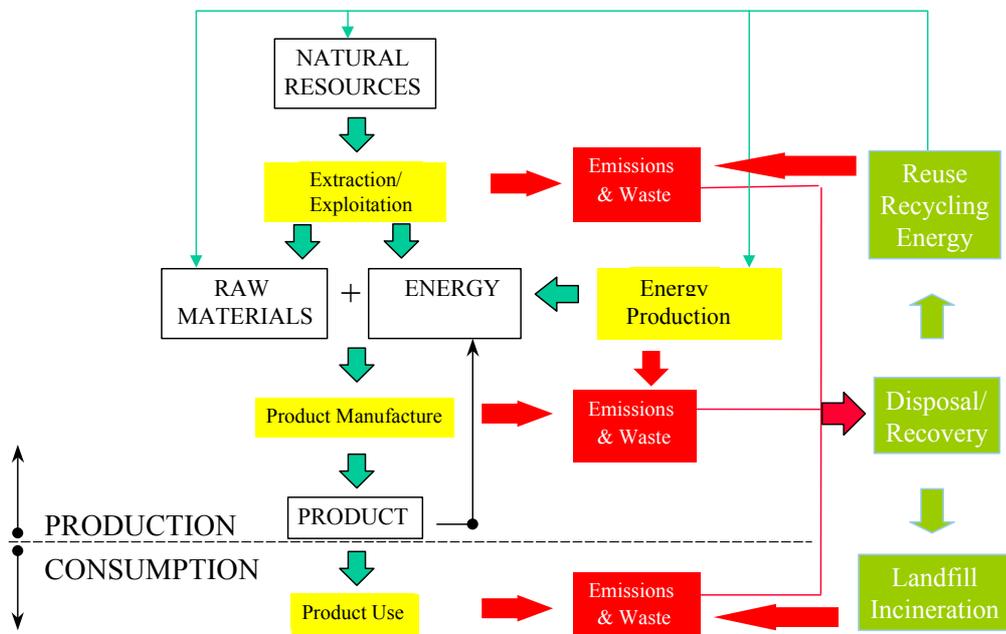
7. Waste Generation and Management

Total waste quantities remain on the increase in most Western European, Central and Eastern European countries (CEE) and Newly Independent States (NIS) and no decoupling of total waste generation from economic growth can be observed at an overall level with a few exceptions. Agreed objectives to stabilise the generation of municipal waste in Western Europe have not been met. On the contrary, quantities are increasing in most Western European countries. For most of the CEE and NIS countries, there is a tendency of a slight increase. Landfilling remains the dominant waste disposal option in Europe. Recycling of waste is increasing in Western Europe, while CEE and NIS countries still have very low recycling rates. Initiatives to promote waste prevention and recycling and raising the standards for safe final disposal of waste have to be considered in the near future as the most effective options to minimise the environmental risks and costs associated with waste generation, treatment and disposal.

7.1 Introduction

Waste is a problem in every European country, and data suggests that waste quantities are generally growing. The lack of available and comparable data for many European countries does not always allow reliable assessment of all waste related issues.

Waste is generated by activities in all economic sectors, and results from inefficient production processes, low durability of goods and unsustainable consumption patterns. The generation of waste reflects loss of materials and energy (see chapter on material flows), and it is causing economic and environmental costs to society for its collection, treatment and disposal. Waste forms only a part of the total material flow through the economy and, particularly in Western Europe, is increasingly being considered in the context of material flows as a whole.



The impact of waste on the environment, resources and human health varies depending on its quantity and nature. Environmental pressures from the generation and management of waste include emissions to the air (including greenhouse gases), water and soil, all with potential impacts on human health and nature. Most of the waste in Europe is landfilled, leading to significant pressures on the environment, while too little is recycled.

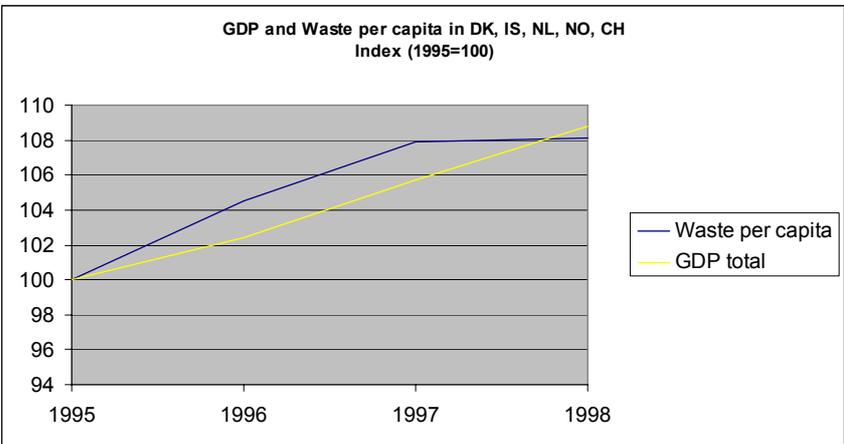
7.2 Trends in waste generation

7.2.1 Total waste amounts

In total, more than 1,300 million tonnes of waste are generated in Europe every year. This equals 3.5 tonnes per capita.

Total waste quantities continue to be increasing in most Western European and NIS countries for which data is available. In Western Europe, only Italy, Spain and United Kingdom have shown a decrease in total waste quantities from 1995 to 1999 while all NIS countries have reported an increase in this period. In CEE the picture is less clear: some countries have experienced an increase (Czech republic, Hungary, Poland) while in Estonia and Slovak Republic decreasing tendency has been identified. In general, limited data sets do not allow accurate assessment of the existing situation.

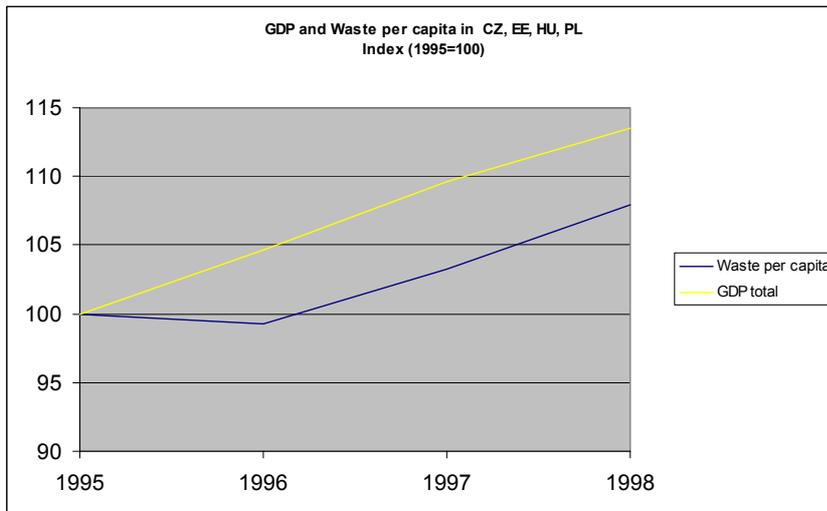
Figure 7.1. GDP and Waste per capita for five Western European Countries



Source: Eurostat (New Cronos)

Limited data for some Western European countries - Denmark, The Netherlands, Norway, Iceland and Switzerland (1995-1998) - indicates that there are no observable signs of decoupling when comparing the total waste per capita and the economic growth in these countries.

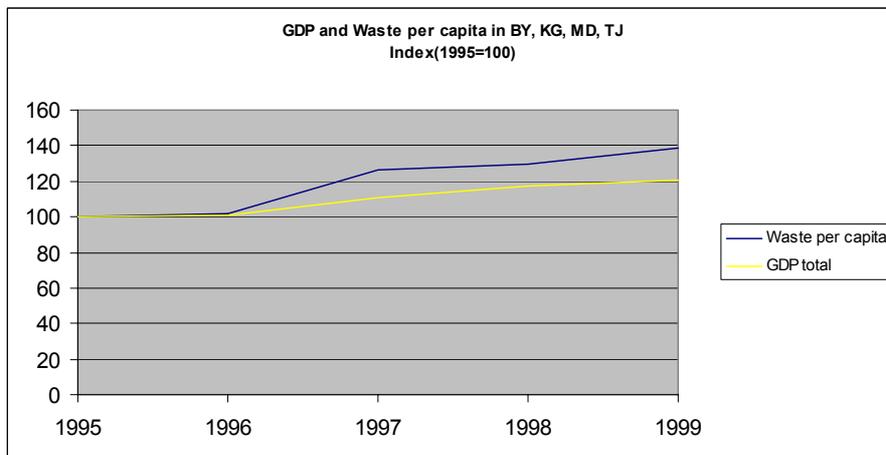
Figure 7. 2. GDP and Waste per capita for four CEE Countries



Source: Eurostat (New Cronos)

For CEE, a time series for total waste in the period 1995-1999 exist for only four countries (Czech Republic, Estonia, Hungary and Poland). Comparing the average total waste generation per capita with GDP for these countries show no signs of a de-coupling of waste generation from economic growth since the generation is increasing at approximately the same rate as GDP.

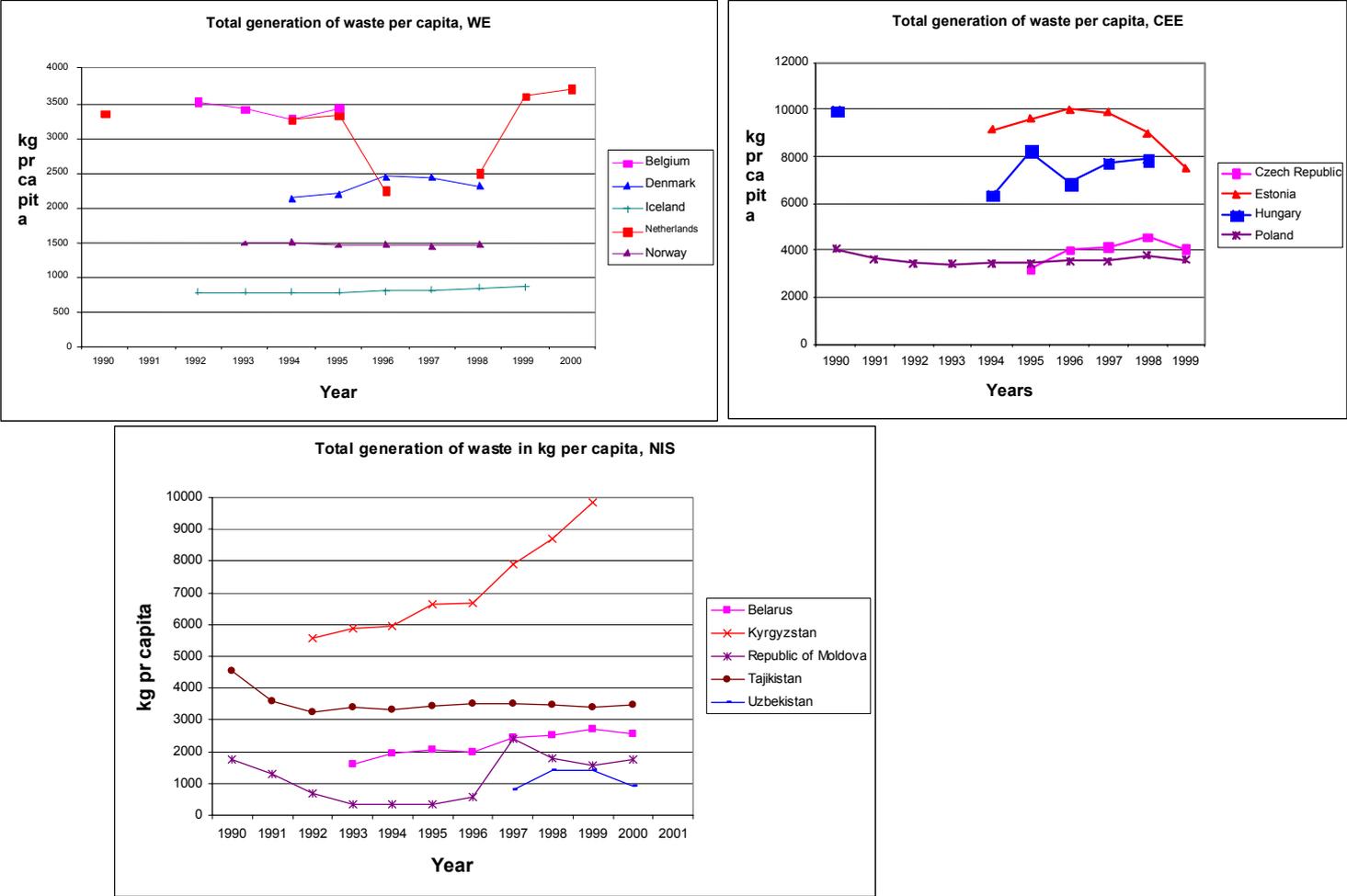
Figure 7. 3. GDP and Waste per capita in four NIS Countries



Source: EEA Survey on waste data from NIS (2002)

The same development as in CEE can be observed in the NIS countries. For NIS countries there is also only a limited time series available, from 1995-1998, and only for four countries (Belarus, Kyrgyzstan, Republic of Moldova and Tajikistan). As for the CEE countries, total waste generation per capita for these countries grow at approximately the same rate as GDP. Thus there are no observable de-coupling of waste generation from economic growth.

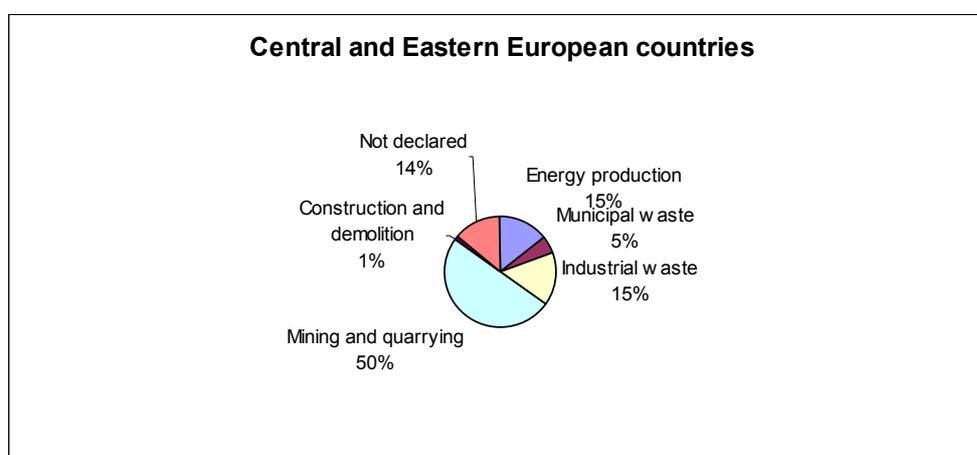
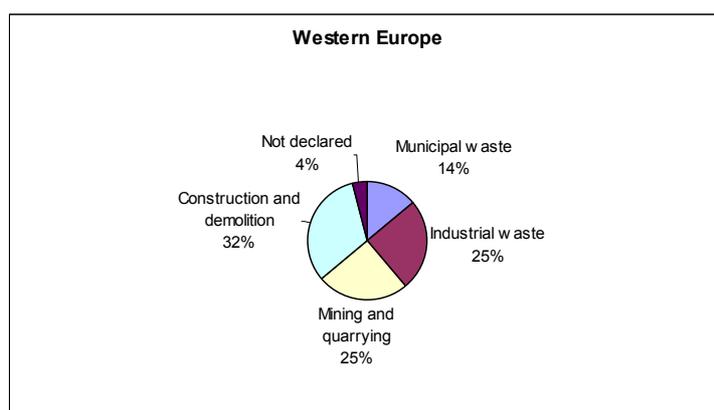
Figure 7. 4. Total waste generation per capita in countries in Western Europe, CEE and NIS, 1990-2000



Note: Some countries in WE, CEE and NIS were not included due to lack of consistent time series.
 Source: Eurostat (NewCronos), EEA survey on waste data from NIS (2002)

Manufacturing industry, construction and demolition activities, mining and quarrying and agriculture are the main economic sectors contributing to total waste in Europe. Other important waste types are municipal waste, hazardous waste, waste from end-of-life vehicles, sewage sludge, packaging waste, and waste from energy generation.

Figure 7. 5. Total waste generation by sector



Source: Eurostat (New Cronos)

Note: Figure for WE does not include BE, IS, LU, NO, SE, ES, CH.

7.2.2 Municipal waste

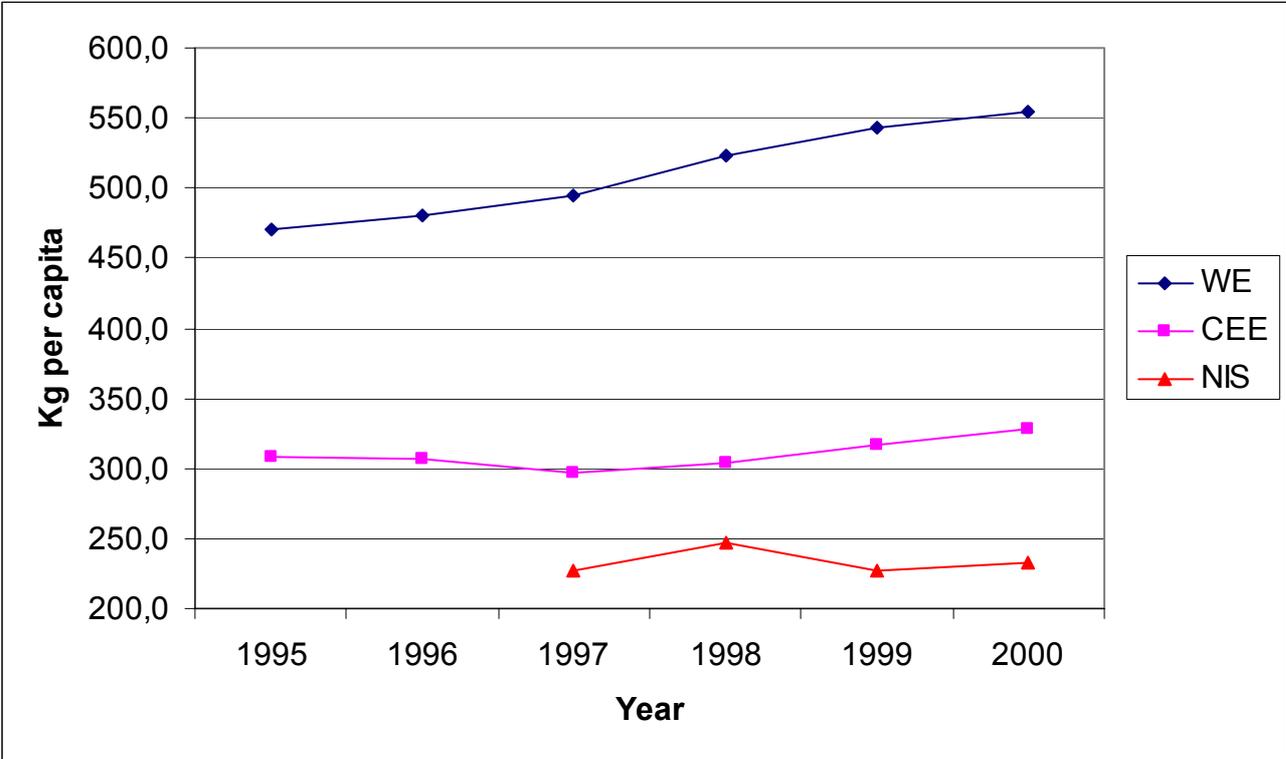
Municipal waste arisings in Europe are large, and they continue to grow. 306 million tonnes are estimated to be collected in European countries each year, representing an average of 415 kg per capita. The collection of municipal waste varies considerably among countries and lies in the range of 685 kg/capita (Iceland) and 105 kg/capita (Uzbekistan). Municipal waste accounts for approximately 14 % of total waste arisings in Europe, and it is traditionally landfilled. Landfilling still is the predominant treatment option in most countries in Western Europe, CEE and NIS.

The 5th Environmental Action Programme of the European Community set a target of stabilising municipal waste generation in the EU at 1985 levels (300 kg per capita) by 2000. This target has been significantly exceeded in almost all Western European countries by 75-100%. In the 6th Environmental Action Programme, agreed in 2002, no quantitative waste targets have been included. The landfill of municipal waste has decreased from 67% in 1995 to 57% in 1999 in EU countries, while composting and recycling rates increased.

In Central and Eastern Europe, municipal waste collection rates are lower than in Western Europe, and this is a result of different levels of economic prosperity, different consumption patterns and municipal waste disposal systems. Many parts of CEE and NIS, particularly rural areas, are not served by municipal waste collection systems. In CEE countries where data is available, it is observed that municipal waste generation, though currently lower than in other parts of Europe, is also increasing whereas in NIS countries the collection rates seem to be stable over the last years. Municipal waste landfills are often overloaded, improperly operated and maintained, and do not meet environmental

and human health requirements. Illegal dumping of municipal waste, in particular in rural areas, is also common in many countries (UNEP, 2002).

Figure 7. 6. Municipal waste collected in countries in Western Europe, CEE and NIS.



Source: Eurostat (New Cronos), EEA survey on waste data from NIS (2002)

BOX 7.1. Biodegradable Municipal Waste

In 1995, approximately 107 million tonnes of biodegradable municipal waste was generated in Western Europe¹, of which 66% was landfilled. (EEA, 2001). Biodegradable municipal waste makes up approximately 60% of the municipal waste stream. It is generated by households and through commercial activities and covers waste such as food, garden waste, paper and cardboard (EEA, 2001). Biodegradable municipal waste is a major contributor to the generation of leachate, landfill gas, odour and other nuisances in landfills. Alternative treatment methods, such as composting or anaerobic digestion, if properly controlled, can eliminate or significantly reduce the polluting and emission potential of biodegradable waste.

The EU Landfill Directive imposes rather strict targets for the reduction of biodegradable municipal waste that may be disposed of to landfill, namely a reduction to 35 % by 2016 of the amounts going to landfill, taking 1995 as the starting point. Source separation, separate collection, more incineration, more composting and bans on landfilling are among the key instruments needed to reach this target.

¹ Only EU countries and Norway.

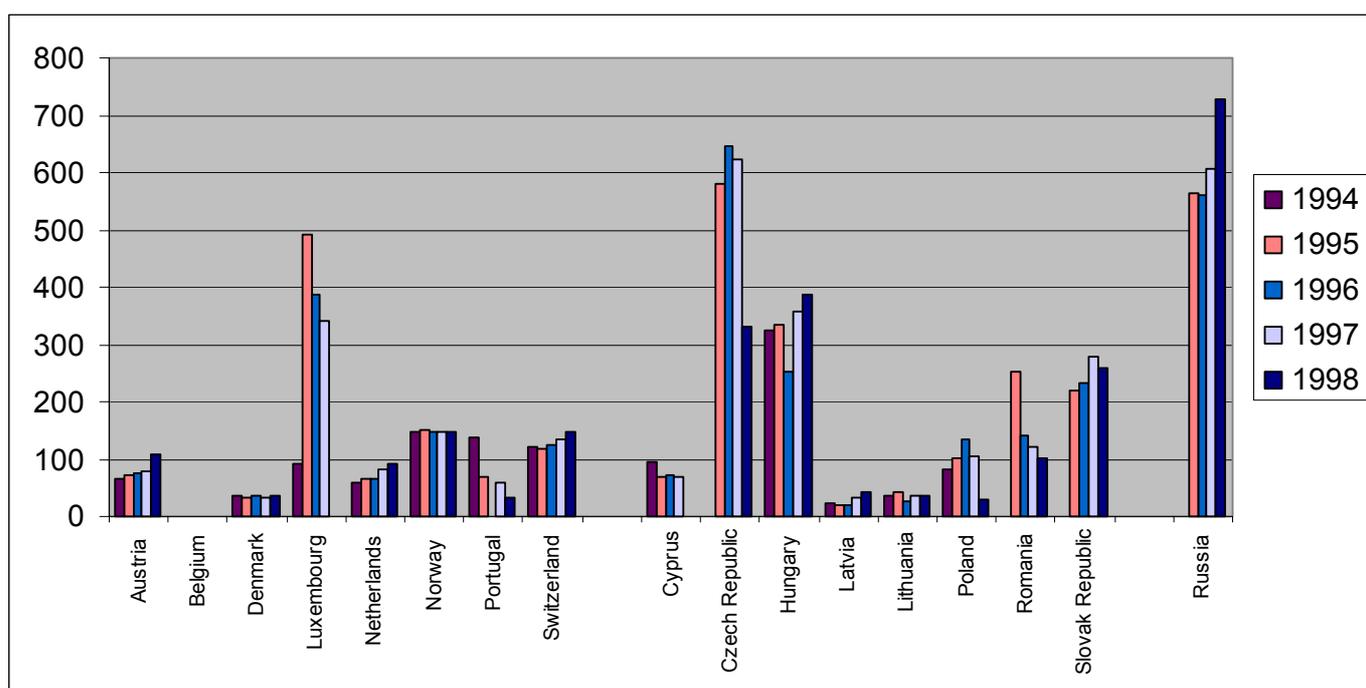
7.2.3 Hazardous waste

Hazardous waste accounts for about 1% of all waste generated in Europe. However, due to the content of dangerous substances, the risk of environmental and human health impacts associated with hazardous waste generation and disposal is disproportionately large to the relatively small quantities generated. Large quantities of hazardous waste are disposed of in ways that cause impacts on the environment and human health (e.g. uncontrolled landfilling), despite international co-operation and agreements to limit such practices (in particular the Basel Convention on Transboundary Movements of Hazardous Wastes and Their Disposal).

Since the mid 1990s, overall quantities of hazardous waste generated per capita have increased slightly in Western Europe by an average of 8% annually². In Russia, the only NIS country for which hazardous waste data is available, quantities increased from 1994 to 1998.

By contrast, in Central and Eastern Europe, quantities generated per capita have decreased since the mid 1990s in the majority of countries for which data is available.

Figure 7. 7. Hazardous waste generation per capita in 17 European countries, 1994-1998



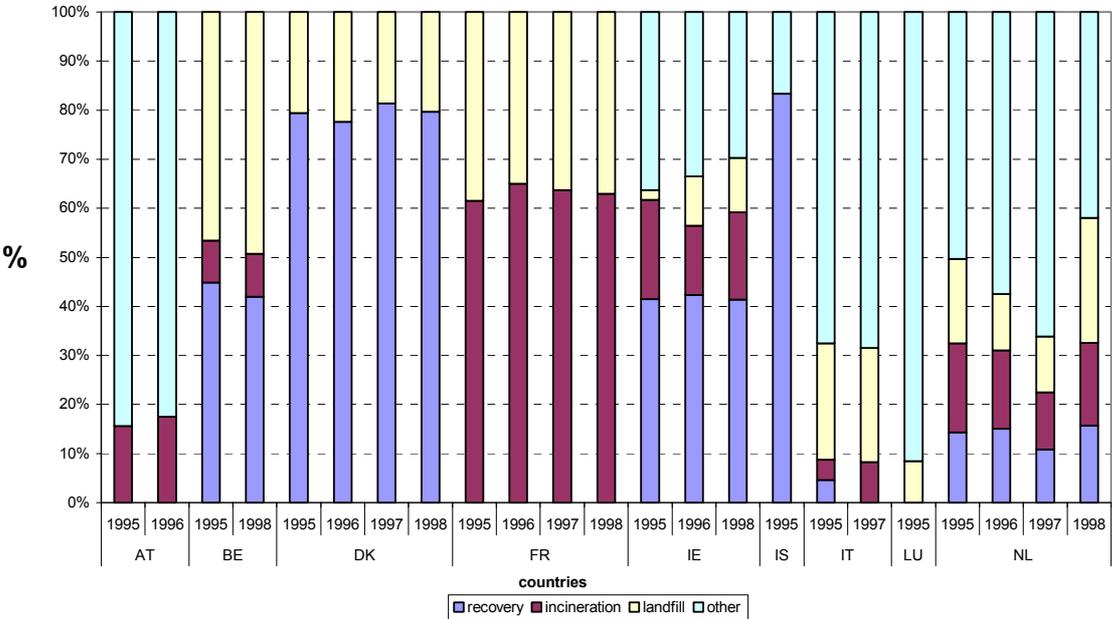
Notes: Selection of European countries includes 5 EU, 2 EFTA and 10 Accession countries. Showing only countries with at least 4 years of data. Source: Eurostat (New Cronos), EEA survey on waste data from NIS.

A limited number of economic sectors contribute substantially to hazardous waste generation, manufacturing industry being the main source. Hazardous waste is the subject of special legislation. It requires special management arrangements ensuring that hazardous waste is kept separate and treated differently from non-hazardous waste. Studies (EEA, 1999 and EEA, 2001a) have shown that a large proportion of hazardous waste in Western Europe is generated by a relatively small number of sources (typically 75% of hazardous waste generated by 20 principal sources).

² Part of this increase could be due to changes in definitions of hazardous waste.

In some European countries, mainly in Western Europe, recovery has become the dominant hazardous waste management option, while in most other countries landfilling and incineration without energy recovery are still widely applied. Other methods, such as physicochemical or biological treatment, or permanent storage are also widely applied.

Figure 7. 8. Hazardous waste management methods in 9 Western European countries, 1995-1998



Note: Selection of European countries includes 8 EU countries and 1 EFTA country. X-axis: countries are sorted in descending order according to other method. "Incineration" is thermal treatment without energy recovery. "Recovery" includes: incineration with energy recovery, recycling, composting and other recovery methods. "Other" methods include: physicochemical or biological treatment, hazardous waste permanently stored and released into water bodies. Source: Eurostat (New Cronos)

In NIS countries, many known hazardous waste disposal sites are overloaded and not adequately isolated from the environment – thus posing risks on the environment and human health. Because of lack of sound law enforcement and monitoring systems there is a risk of NIS countries becoming "havens" for international trading in hazardous waste (UNEP, 2002). Although all NIS countries (except Kazakhstan and Tajikistan) are parties to the Basel Convention, they lack national capacities as well as finances to fulfil commitments taken under the treaty.

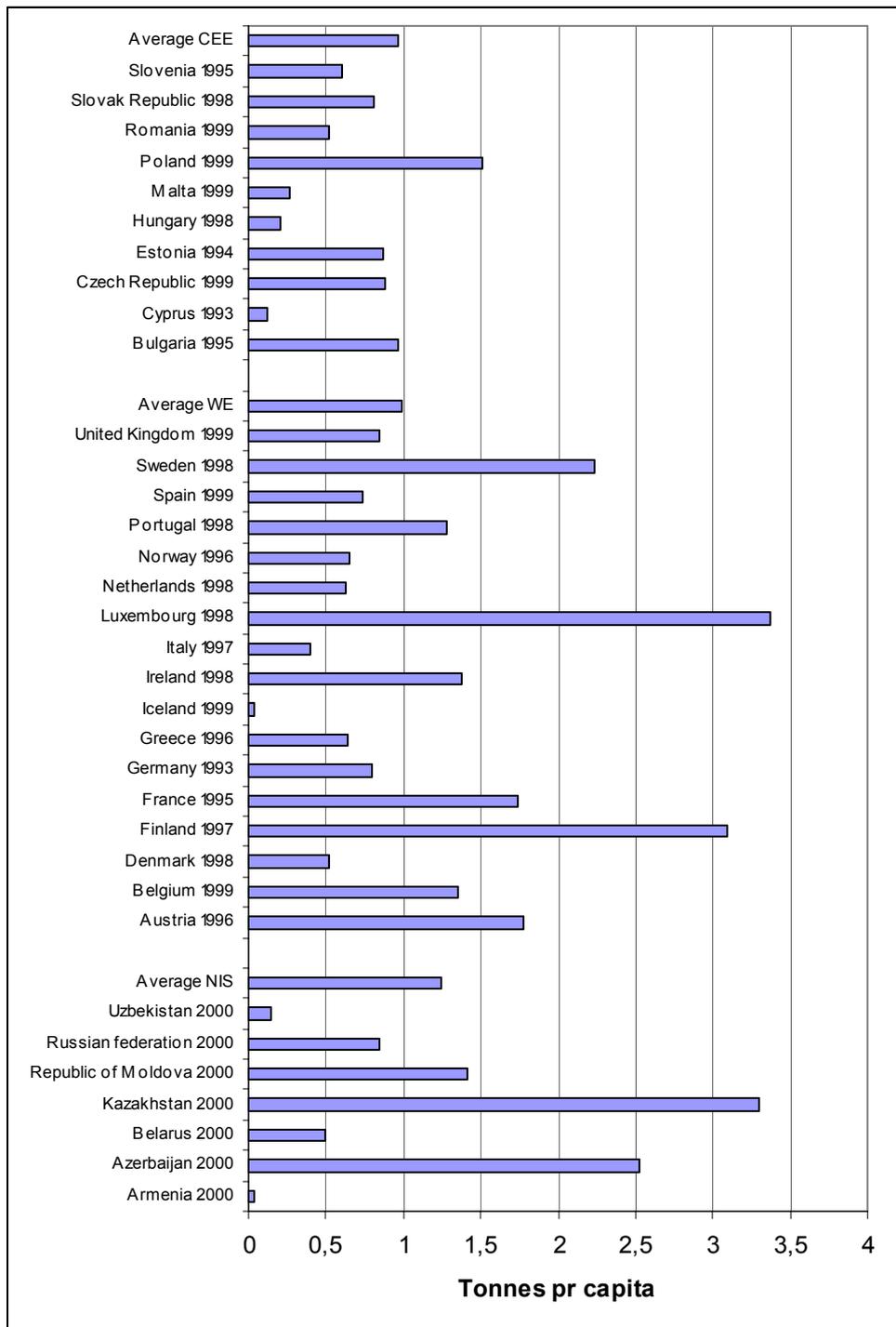
7.2.4 Waste from manufacturing industries

Approximately 740 million tonnes of waste are generated by manufacturing industry in Europe every year. In Western Europe and the NIS countries, manufacturing waste arisings have increased since the mid 1990s in most countries for which data is available. In NIS countries, this increase has followed a period in the early 1990s with a drastic decline in industrial activities, and thereby in industrial wastes, after the disintegration of the Soviet Union. In Central and Eastern Europe the picture is less clear, and some countries including Czech Republic, Hungary, Romania and Slovak Republic, experienced decreasing quantities.

The range of industrial wastes generated is as broad as the manufacturing industries generating them, and so are waste management options combining recycling, recovery and disposal techniques employed. Manufacturing waste is generated by large as well as medium-sized and small enterprises. Small and medium-sized enterprises, and some large

enterprises, do not have the expertise or the resources to ensure that management of their waste does not cause environmental impacts.

Figure 7. 9. Manufacturing waste per capita in European countries

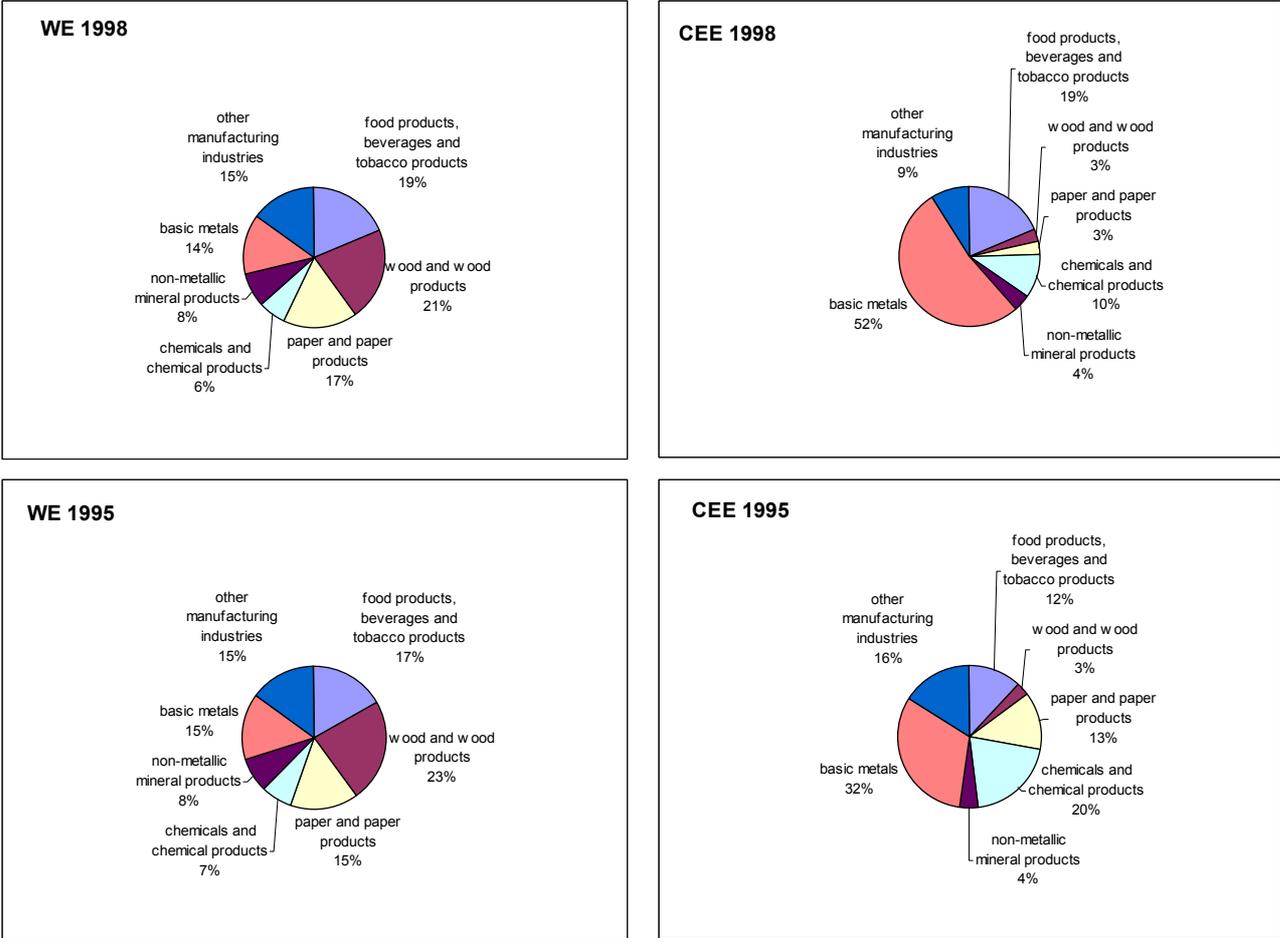


Source: Eurostat (New Cronos), EEA survey on waste data from NIS.

Manufacturing waste consists of food, wood, paper, chemicals, non-metallic minerals, basic metals and other waste. A comparison of Western European countries and CEE countries shows that Western Europe generates the majority of food, wood, paper, non-metallic and other manufacturing waste, while CEE countries generate the majority of chemicals and basic metals waste, mainly from the heavy chemical, iron and steel

industries in these countries³. In 1998, the main contributor to manufacturing waste in five CEE countries was the basic metals industry (contributing about 50%). In Western Europe, no one main contributing industry can be identified, but in five countries the food, wood and paper industry all accounted for about 20% each in 1998. From 1995 to 1998, the contribution of Western European countries to total manufacturing waste generated in Western Europe and CEE increased from 50% to 59%.

Figure 7. 10. Manufacturing waste profiles in Western Europe (WE) and CEE



Notes: The figure for EU only contains data from Ireland, the Netherlands, Portugal, Sweden and Finland. The figure for CEE only contains data from Czech Republic, Hungary, Poland, Romania and Slovak Republic

Source: Eurostat (New Cronos)

In NIS countries, oil industries, mineral resources extraction, and power plants are major generators of industrial waste (UNEP, 2002).

As the supplier of manufactured goods, manufacturing industry can play a central role in reducing the amount of waste generated by:

- Incorporating life-cycle analysis in the design and manufacturing process of goods and services;
- Promoting sustainable use of materials and energy;
- Eliminating or reducing the use of substances or materials hazardous to health or to the environment.

³ Data for WE from Finland, Ireland, The Netherlands, Portugal and Sweden Data for CEE from Czech Republic, Hungary, Poland, Romania and Slovak Republic.

Box 7.2. End-of-Life Vehicles

An increase in the number of end-of-life vehicles can be observed in Western Europe. This is a result of increasing car stocks. In Accession Countries, a total increase of 124% in the amount of scrapped cars is projected between 2000 and 2015. Reasons include the ageing and growing car stock.

Cars contain materials such as lead, mercury, cadmium, hexavalent chromium and other environmentally harmful substances. About 3/4 of a car by weight is steel and aluminium, which is recycled. The rest, mainly plastics, is disposed of to landfill or by incineration. Cars also contain liquid dangerous substances (e.g. anti-freeze, brake fluid, oils etc.) that are harmful to the environment, if not handled properly.

The EU Directive on End-of-life Vehicles (2000/53/EC) has a strong focus on recovery, reuse and recycling of cars. As a consequence, EU Member States will need to focus on improvements in the dismantling and shredder industry. By 2006, 80% of an end-of-life vehicle is to be reused or recycled and by 2015 the projected percentage is 85% is to be reused or recycled. For recovery (including reuse and recycling) the targets are 85% for 2006 and 95% after 2015 respectively.

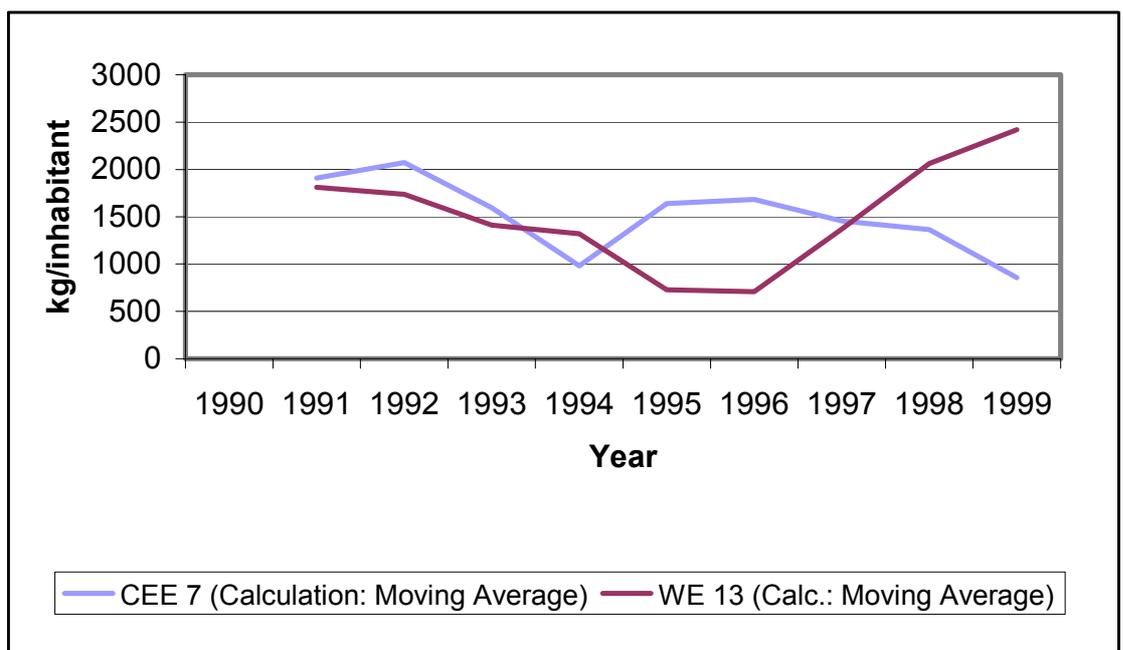
Illegal export of used cars from Western Europe to CEE is likely to cause major end-of-life vehicle waste problems in these countries in the future. (EEA, 2002b)

7.2.5 Waste from mining and quarrying

In Europe, mining and quarrying waste is the largest single category of waste, accounting for over 20% of total waste generated.

Waste from mining and quarrying is on the increase in Western Europe and in some NIS countries. On average, mining waste per capita in Western Europe has increased considerably from 1996 to 1999. In CEE countries, mining and quarrying waste has decreased in the same period, mainly due to the closure of many mining waste producers in, for example, Poland and Romania.

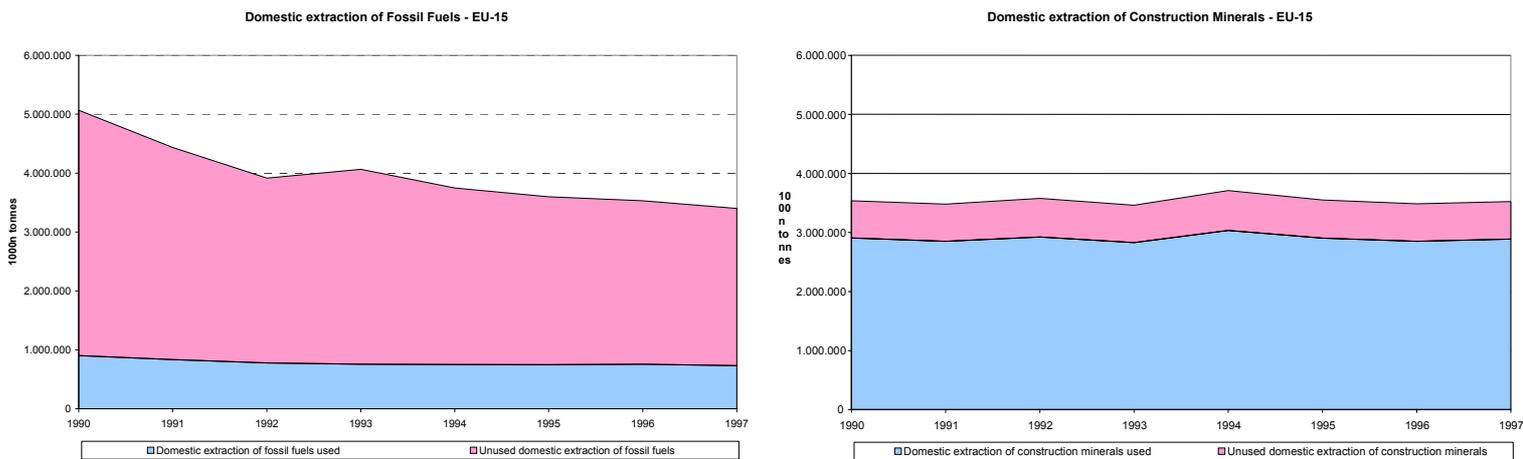
Figure 7.11. Generation of mining waste per capita for Western Europe and Central and Eastern Europe



Note: WE 13: Austria, Belgium, Finland, Germany, Greece, Ireland, Italy, Portugal, Spain, Sweden, The Netherlands, United Kingdom, Norway. CEE 7: Czech Republic, Hungary, Lithuania, Poland, Romania, Slovenia, Slovak Republic
 Source: EUROSTAT (NewCronos)

Landfilling of mining waste takes up large areas of land and cause adverse impacts on air, water and soil quality. In recent years, a number of uncontrolled releases of mining waste to surface waters in Europe have highlighted the risks of poor mining waste management. In response, the EU has proposed initiatives that are designed to improve mining waste management.

Figure 7. 12. Domestic extraction of fossil fuels and of Construction Minerals - EU 15



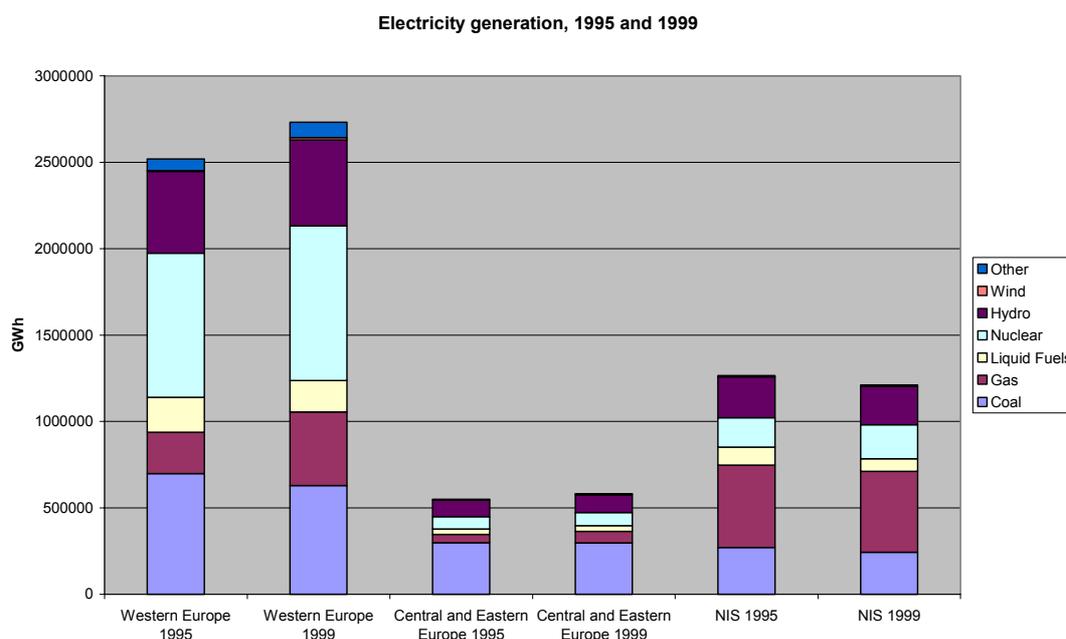
Source: Wuppertal institute, 2002

In many European countries, waste from mining and quarrying activities is not subject to environmental or waste management legislation. Consequently, information on waste quantities and management is scarce and the quality of data poor. Most mining and quarrying activities result in the extraction of material that is not used subsequently and must be landfilled or otherwise disposed of. For example, fossil fuel extraction results in up to 80% unused material. In contrast construction minerals extraction results in less than 20% unused material.

7.2.6 Waste from energy production

The quantity of waste generated as a result of energy generation varies depending on the fuel used. Hydroelectric and gas fired power stations generate no solid waste. Coal fired power stations on the other hand generate large quantities of bottom ash and fly ash. Nuclear power stations generate waste that requires specialised and expensive management. A shift to cleaner (e.g. natural gas) and renewable sources of energy will result in reduced waste quantities.

Figure 7. 13. The profile of electricity generation in European regions



Source: International Energy Agency (IEA): Basic Energy Statistics of OECD Countries and non-OECD Countries (2001 edition)

Overall, the generation of electricity from coal and liquid fuels is decreasing and the use of natural gas is increasing. In Western Europe there has been an increase in the use of nuclear power and hydro power. Wind power is also increasingly used, but it still only constitutes a very small fraction of overall electricity generation. A minor increase in electricity demand in Central and Eastern Europe has been met principally by an increase in the exploitation of natural gas and hydro power. An increase in nuclear power generation is evident in Newly Independent States.

7.2.7 Waste from construction and demolition activities

Construction and demolition waste is generated from construction activities including the renovation of old buildings, and it accounts for approximately 32% of all waste generated in Western Europe and only a declared share of 2 % in CEE. Construction and demolition waste can contain dangerous substances such as asbestos, which can be present in significant proportions, when old buildings are demolished or renovated.

In the 1990s, Western Europe has generally experienced an increase in the generation of construction and demolition waste. Seven Western European countries experienced increases in per capita construction and demolition waste generation, while four countries have seen stable developments and another four have experienced a decrease (EEA 2002c). In CEE, four of the five countries for which there is data have seen increasing quantities since 1995. Time series are not available for NIS countries.

In many countries, construction and demolition waste is largely disposed of to landfill, despite its readiness for recycling. However, some countries in Western Europe - such as Germany, Denmark and the Netherlands - have achieved up to 90% recycling of construction and demolition waste.

Many components of construction and demolition waste are readily recyclable, and they have the potential to replace up to 10% of virgin raw materials. In order to promote the sustainable use of raw materials the possibilities of recycling some of the components of the construction and demolition waste should be exploited.

7.3 Waste management

7.3.1 Review of policies

A broad range of political, regulatory and economic instruments is in use in Europe to steer generation and management of waste.

According to EU legislation (Directive 75/442/EEC), all Member States are imposed to produce one or more waste management plans. Such plans shall relate in particular to: the type, quantity and origin of waste to be recovered or disposed of; general technical requirements; any special arrangements for particular wastes; and suitable disposal sites or installations. The aim of a waste management plan is to create an overview of the state of affairs in order to be able making well founded decisions for the future.

Twelve EU countries have made national waste management plans or strategies while three countries have prepared regional plans. In Eastern and Central Europe the elements for national waste management plans are included in several documents (DHV 2001). No information is available on NIS.

Command and control measures are widely used in all European countries, especially as regards hazardous waste management. For non-hazardous waste the use of economic or market based instruments are on the increase in Western, Eastern and Central European countries. An important aspect is to make the polluters (i.e. the enterprise or household generating waste) aware of the costs of their actions and give opportunities for alternative options. The costs are usually shown in user charges through the costs of collection and treatment of wastes and through taxes. Pay-as-you-throw schemes are gaining ground in several countries.

In Western European countries, producer responsibility has been implemented for various waste streams such as packaging, batteries, waste from electrical and electronic equipment, paper and tyres. Voluntary agreements between authorities and industry have also taken place to some extent (e.g. end-of-life vehicles, construction and demolition). A tax on landfilling has become a widely used instrument and is now in use in nine countries. The design of the instrument varies greatly, and so does the level of the tax.

The most commonly used instruments in Eastern and Central European countries for non-hazardous waste are municipal waste user charges and waste disposal charges (DHV 2001). Furthermore, several countries have introduced deposit refund on beverage containers. Taxes on waste are only used in two countries, Estonia and Romania (REC 1999). No information is available on NIS countries.

However, in designing economic instruments adverse impacts of incentives should be taken into account. If the rate of a user charge or tax is too high, the risk of illegal dumping will increase.

7.3.2 Challenges for the future – the way forward

It was concluded in a recent study (EEA, 2000) that three principal impacts of landfill and incineration are considered significant on a global level because of their potential for transboundary migration: organic micro-pollutants (dioxins and furans); greenhouse gases (methane) and volatile heavy metals. Other emissions from incinerators (HCl, heavy metals and salts) and landfill sites (nitrogen, ammonia, organic compounds and heavy metals), if uncontrolled, have the potential to cause severe contamination problems due to the dangerous substances contained and emitted. Therefore the minimisation of waste generation especially for those potentially causing adverse impacts on the environmental quality and health is the major challenge to be tackled in the forthcoming years.

The preceding sections have shown that there is still much scope for improvement, as waste arisings are still growing in almost all regions of Europe. In doing so, waste prevention initiatives have to be widely introduced in order to limit this discouraging trend: waste prevention reflects the evident fact that if it is possible to avoid the generation of waste at source, there is no need for collection and treatment facilities, and environmental impacts resulting hereof are avoided. Furthermore, natural resources and materials are saved bearing in mind that waste is “wasted raw material”.

Waste prevention translates into a need to design materials, goods and services in such a way that their manufacture, use, reuse, recycling and end-of-life results in the least possible generation of waste. Particularly in growing economies, waste prevention is a heavy challenge, calling for de-coupling of waste generation and economic growth.

Figures concerning recycling are also rather discouraging. The rate of recycling is minimal in many countries in Western Europe, Central and Eastern Europe and NIS. Only in a few Western European countries, recycling of some waste fractions has increased considerably in the last decade. In the EU, recycling (including composting) of municipal waste was 11% during 1985-90 and 15% in 1995 (EEA 1999). For Central and Eastern Europe no concrete figures on recycling of municipal waste are available, but it is estimated to be less than 10%. For NIS, information is only available on total recycling and only for three countries. Ukraine has a total recycling of 31-42%, in Belarus it is 14-15% (only industrial waste) and in Uzbekistan it is 6-15%.

Thus, there seems to be plenty of room for increasing the level of recycling in almost all European countries. A major challenge is to establish new, and to some extent, more comprehensive collection and recycling schemes. For some waste streams (e.g. construction and demolition waste) solutions may be fairly straightforward, while others (e.g. waste from electrical and electronic equipment) may demand a more complex system. Several countries may not generate sufficient quantities of certain wastes to be able to treat them in an economically efficient way. As a result a large potential exists for co-operation between countries, especially in Eastern and Central Europe and NIS.

Incineration with energy recovery is also an option to avoid landfilling. In Western Europe 17% was incinerated in 1995 (EEA 1999). In Eastern and Central Europe this share was 2.3% in 1995 and 6% in 1999. No information is available on NIS countries.

Landfilling is the lowest ranking waste management option in the waste hierarchy, but it remains the most predominant option in Europe. 67% of municipal waste in Western Europe was landfilled in 1995 (EEA 1999). For Eastern and Central Europe, the share of municipal waste led to landfill was 83.7% in 1999 (DHV 2001). No information on landfilling is available for NIS, but it is clear that it is by far the most used option. In the environmental outlook for Caucasus (UNEP 2002), the situation is described with overloaded, improperly managed and maintained municipal waste landfills that do not meet minimum health and environmental standards. Thus, to meet the waste hierarchy, diversion of wastes away from landfill to higher-ranking management options is called for.

Another challenge in the future is to raise standards of landfills and to close improperly managed and maintained sites. In existing and coming EU Member States, compliance with the EU Directive on the Landfill of Waste (1999/31/EC) is expected to significantly reduce the potential for environmental pollution from landfills. The Directive imposes stringent operational and technical requirements on landfilling, and it requires a reduction in the quantity of various waste streams entering landfills as well as treatment of all waste prior to landfill.

The EU Directive on Waste (75/442/EEC) imposes Member States to establish an integrated and adequate network of disposal installations. This may be done in co-

operation with other Member States. The network must enable the Community as a whole to become self-sufficient in waste disposal, and it must reflect the fact that certain wastes, particularly hazardous waste, may not be generated in one country in sufficiently quantities to warrant the establishment of a dedicated disposal facility in that country.

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