06

Sustainable consumption and production

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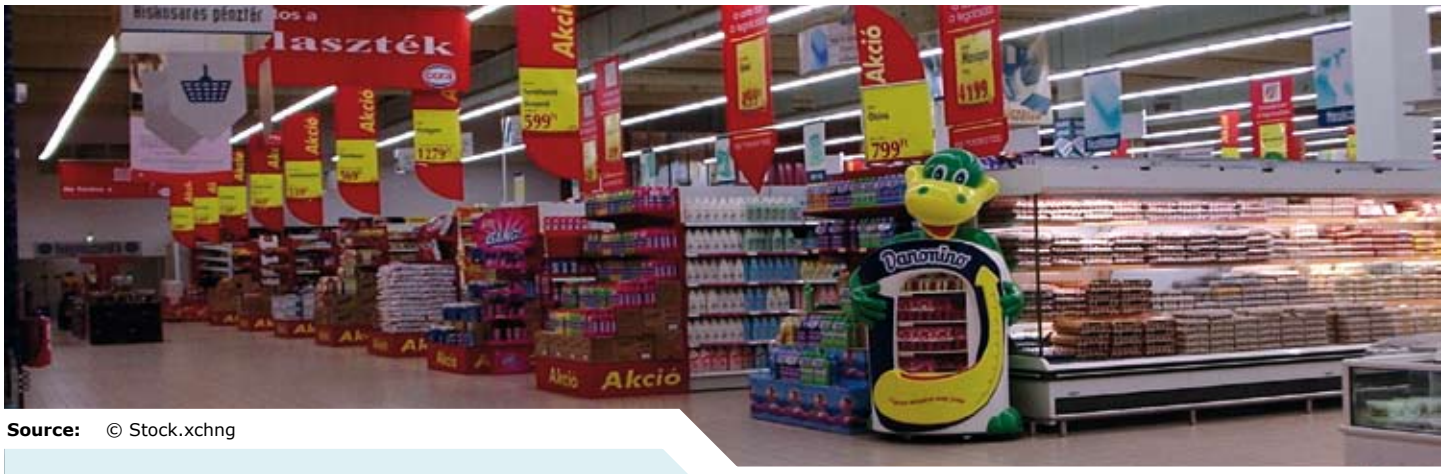

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Key messages

In the years since the Kiev conference in 2003, sustainable consumption and production (SCP) has become more prominent on the policy agenda although few substantive results have yet emerged. The impacts on the environment of increased production and consumption are growing. The challenge for all countries is to break the link between economic growth and environmental impacts from consumption, resource use and waste generation.

Production and resource use:

- The economic sectors which cause the most significant environmental pressures in WCE are: electricity, gas and water supply; transport services; and agriculture. These priority sectors are likely to be the same in EECCA and SEE countries, although the impact of mining and construction, together with production of basic metals and industrial minerals, are also expected to be significant.

- The main trade flows from WCE and SEE to EECCA are in manufactured goods. EECCA countries primarily export fuels and mining products to WCE and SEE countries. Such asymmetry causes a shifting of environmental impacts across borders.

- Over the last decade, per capita use of resources in the pan-European region has been stable. Efficiency of resource use varies significantly between countries. It is several times higher in EU-15 than in EU-10 and SEE countries, and up to twenty times higher than in EECCA.

- The projected outlook for resource use in both EU-15 and EU-10 is for a progressive increase toward 2020, which highlights the urgency of promoting sustainability.

- A life-cycle approach in policy-making ensures that impacts are assessed from cradle to grave, and environmental impacts are not simply hidden by moving them to different countries or different stages of production or consumption.

- As well as improving energy efficiency across the region, it is essential to invest in innovative technologies that reduce resource use. This includes bringing these technologies to the market.

Consumption:

- Household expenditure is between three (EU-15) and five (SEE) times higher than public expenditure. Household consumption per capita is on the increase in all European countries, with levels about four times higher in EU-15 than in EECCA countries.

- Patterns of consumption are changing rapidly across the region with the food component decreasing, and the shares for transport, communication, housing, recreation and health on the rise. In EECCA, many rural households still have little or no surplus for non-essential goods. However, a small but growing urban middle class is increasingly adopting the consumption patterns of WCE.

- Food and beverages, private transport and housing (including construction and energy consumption) are those consumption categories that are causing the highest

life-cycle environmental impacts. In WCE, tourism and air travel are emerging as future key impact areas.

- Whilst some decoupling of economic growth from domestic resource and energy use have been noted in both EU and EECCA, it is not clear to what extent changes in consumption patterns have contributed to this since most high-impact consumption categories are actually increasing.

- Changing consumption patterns cause increased impacts as spending shifts to more impact-intensive categories (transport and household energy use). Within these categories, growth in consumption has more than offset benefits from improved technological efficiency.

- Environmental impacts of consumption can be reduced by specific controls at sites of production, use and disposal or by transferring demand from higher to lower impact consumption categories. Policy options for public authorities include improved environmental information and labelling, green public procurement and market-based instruments. Green taxes increased in EU-15 from 1992–1995 but subsequently stagnated. Applying such mechanisms to break the link between growth and impacts are likely to be equally challenging in the expanding economies of EECCA and SEE countries.

Waste:

- On aggregate, the pan-European region is generating ever more waste. The amount of municipal waste increased by an average of 2 % each year and even more in EECCA. The intensification of economic activities outweighs the effects of waste prevention initiatives.

- The volumes of waste range from less than 0.5 tonnes to 18 tonnes per person. Per capita waste generation is, generally, higher in EECCA than in EU countries due to large amounts of waste from raw material extraction and processing industries.

- Three to four percent of this amount is hazardous waste which presents a special risk to human health and environment. The waste sites, inherited from the past, present a major problem in EECCA countries and, to a lesser degree, in the SEE region. Problems arise mainly from the storage of hazardous waste and old chemicals, including pesticides.

- Landfill is still the most common method of waste management across the pan-European region. However, increasing amounts of municipal waste in the EU are now diverted away from landfills as a result of regulations and targets. In the EECCA and SEE countries there has been no measurable progress in recycling and recovery of municipal waste since the Kiev conference.

- EU and EFTA Member States are increasingly focusing on utilising the resources in waste. In the EECCA and SEE countries, recycling is driven by financial interests and thus tends to concentrate on industrial waste.

- Many EECCA and SEE countries have developed waste strategies and legislation for specific waste streams. However, many countries have yet to prepare and implement waste management plans and effective legislation. Proper collection and safe landfill still remain a challenge.

6.1 Introduction

Sustainable consumption and production (SCP) was put on the global policy agenda at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro. Globally, the political framework for action on SCP is based on the Johannesburg Commitment made at the 2002 United Nations World Summit for Sustainable Development and the Marrakech Process launched in 2003. The EU Sustainable Development Strategy, revised in 2006, identified sustainable consumption and production among its seven key challenges, and the EU is currently developing an Action Plan on Sustainable Consumption and Production. The importance of SCP was also recognised within the Environment-for-Europe process. In the 2003 Kiev Declaration, Environment Ministers stressed:

... the importance of the shift towards sustainable production and consumption patterns and encourage regions, subregions and countries, as appropriate, to devise programmes to accelerate this shift.

Sustainable consumption and production has been defined as:

… a holistic approach to minimising negative environmental impacts from the production-consumption systems in society. SCP aims to maximise the efficiency and effectiveness of products, services, and investments so that the needs of society are met without jeopardising the ability of future generations to meet their needs (Norwegian Ministry of Environment, 1994).

The concept encompasses the three pillars of sustainability: economy, society and the environment. The social component is concerned with equity within and between generations, together with consumer protection. The economic and environmental dimensions were described by the Kiev Declaration as 'the delinking of economic growth and environmental degradation, so as to promote both economic growth and environmental protection'. Achieving this in the pan-European region was declared to be 'crucial'.

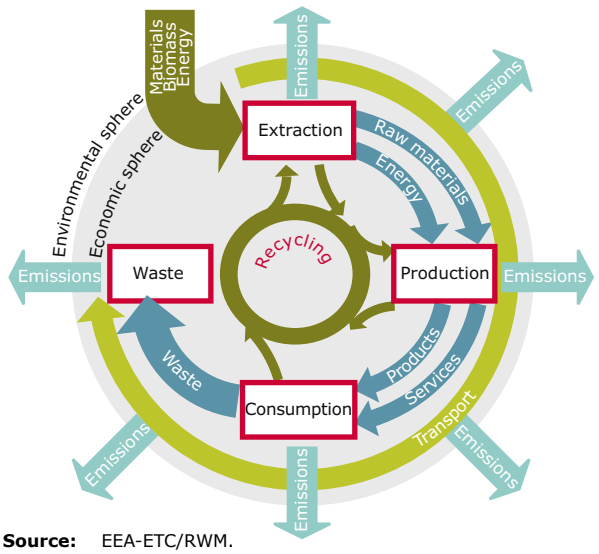
This chapter will mainly focus on the environmental and economic aspects of SCP. The SCP is consistent with a life-cycle perspective on resource use which provides for identification of the most critical points of intervention needed to achieve environmental improvements throughout the product life cycle. The SCP process extends this life-cycle perspective to the economy as a whole and encompasses relationships which cross over geographical borders and environmental media.

This chapter examines trends and drivers for SCP across the pan-European region, following the sequence of a life-cycle chain — from resource extraction through production and consumption to waste disposal.

Production activities and use of resources are considered in Section 6.2. Evidence of decoupling the use of resources from the economic growth is examined. The analysis also reviews environmentally critical sectors and the efficiency of resource use. Section 6.3 outlines trends in those consumption categories which generate the greatest life-cycle environmental impacts, and discusses the role of households. Section 6.4 looks at trends in waste generation and reviews progress of waste management measures introduced to ensure environmental protection and the re-use of resources and energy.

Throughout the chapter, the three main country groupings (WCE, SEE and EECCA) are sometimes divided further to provide a more meaningful

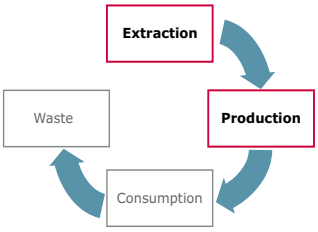
Figure 6.1 Life-cycle chain from extraction — through production — to consumption and waste



Source: EEA-ETC/RWM.

analysis. Hence, when available data allows, the analysis differentiates between EU-15 + EFTA and EU-10 within WCE, and between eastern Europe, the Caucasus and Central Asia within the EECCA group (see Chapter 1 for details of country groupings).

6.2 Production and resource use



The first two stages in the life cycle encompass the extraction of materials, biomass and energy, and their use for production or manufacturing activities. Comparing economic activities (e.g. GDP, gross value added) with the amounts of resources and energy used, or the amount of pollution emitted, allows areas of inefficiency, overuse, and excess to be highlighted together with their damaging environmental impacts.

This section will mainly focus on production activities and their impacts and explore the relation between resource use, emissions, and economic output.

6.2.1 Production and related impacts

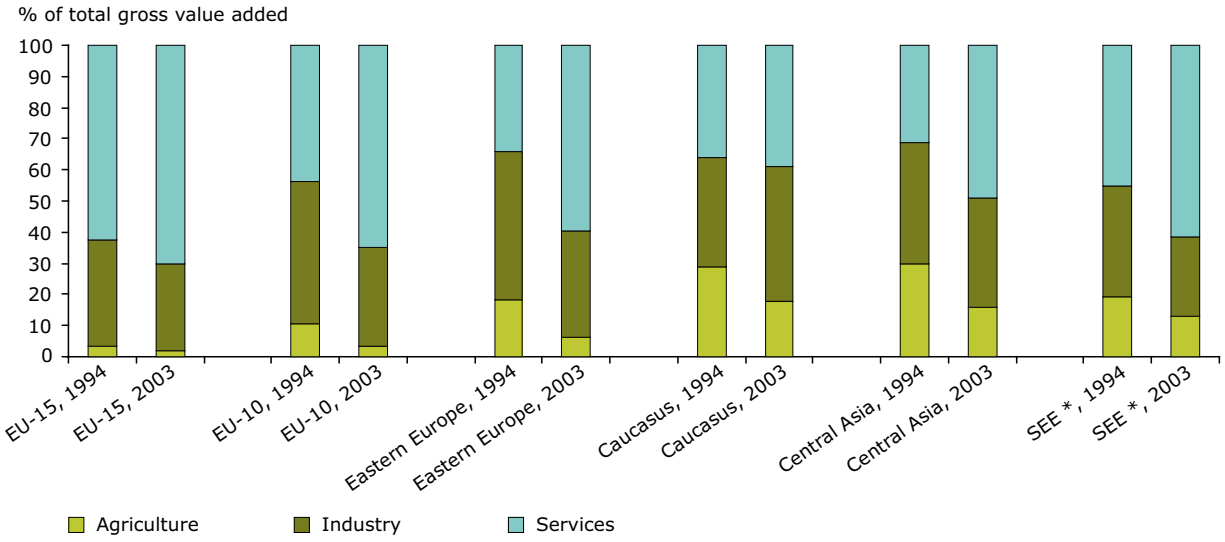
The fundamental socio-economic changes experienced by many countries in the pan European region since the beginning of the 'Environment for Europe' process, have had a strong impact on their level of wealth and structure of their economies. These changes have also affected their patterns of natural resource use and the state of their environment.

Structural changes in the economies

Since 1990, all countries in Europe have experienced a structural change towards service oriented economies, resulting in an increased contribution of services to GDP (Figure 6.2).

The process of economic change has been characterised by strong regional differences. The economies of EU-15 Member States are service-dominated (services 70 %, industry ([1]) 28 % and agriculture 2 %). Within the economies of

Figure 6.2 Structural changes in the economy by region



Note: * = Data available for Bulgaria, Romania and Turkey only.

Source: Adapted from World Bank, 2005.

([1]) The term 'industry' covers mining, energy supply and manufacturing. The term 'services' covers, among others, wholesale and retail trade, repairs, hotels and restaurants, transport, communication, financial services and real estate, public administration, defence, education, health care and various other services.

EU-10, the share of services rose to 65 %, while industry dropped to 32 %. After a significant decline over the last decade, agriculture now accounts for only 3 % of gross value-added. Amongst the SEE ([2]) countries, the contribution from services increased to 61 %, with agriculture still relatively high at 13 %, whilst that of industry was 26 %.

Within the EECCA region, changes have been even more dramatic. Here, the service sector has almost doubled, from 34 % to 60 %, at the expense of industry (down from 48 % to 34 %) and agriculture (18 % to 6 % ([3])). In the Caucasus and Central Asia the contribution from agriculture remains high, at 18 % and 16 % respectively, whilst that from the service sector is the lowest in these regions, at 39 % and 49 % respectively.

As the economies move away from reliance on heavy industries and intensive agriculture towards services, which tend to be less pollution-intensive, environmental pressures are expected to decrease. This, however, will depend on how industrial production changes in absolute terms, and on which technologies are used. Since the beginning of the 1990s, environmental impacts from industry within the EU-25 have, indeed, decreased. This has been a result of stricter regulation, better enforcement and the closure of heavy industries within the new EU Member States. The situation in EECCA is less clear as the availability of data has only improved in recent years and there are no comparable long-term data series.

Environmental impacts and priority areas for policy

One of the key challenges in environmental policy-making is to decide which economic sectors, products or resources should be the target of policy intervention. When evaluating impacts from production, focus should be on the environmentally critical elements which cause high environmental impacts.

Few reliable and widely accepted methods are currently available for measuring the environmental impacts of resource use and production activities (EEA, 2005a). While it is possible to measure the amounts of pollutants emitted or waste generated, calculating what impacts this has (in terms of human health, ecotoxicology, loss of biodiversity etc.) is not possible at present. More comprehensive figures on environmental impacts of economic activities are therefore not currently available. Research is progressively being carried out, however, to help identify environmentally critical sectors of the economy and to pinpoint priority areas for policy intervention.

Priority economic sectors

As far as industry and the production are concerned the economic sectors which generate significant environmental pressures, in addition to the household sector, are electricity, gas and water supply; transport services; and agriculture (Figure 6.3). An ongoing EEA study of eight EU Member States (Moll *et al.*, 2006) has shown that these sectors accounted for around 50 % of greenhouse gas emissions and 80–90 % of all emissions of acidifying gases. With regard to materials use, the mining industries and the agricultural branch account for the majority of direct materials input.

Other significant sectors in this respect include: manufacture of steel and non-ferrous metals and products thereof, manufacture of coke, refined petroleum products, nuclear fuels, chemicals, chemical products, man-made fibres, and manufacture of non-metallic mineral products such as cement and glass.

These findings are consistent with the so-called EIPRO project commissioned by the European Commission (European Commission, 2006a), which identified eight 'core activities' causing

([2]) Data on economic structural change are only available for Bulgaria, Romania and Turkey, which represents 88 % of the total SEE countries' GDP.

([3]) The most significant fall in the contribution of agriculture was in the Russian Federation, skewing the total for the four East European countries. The share of agricultural activities in Belarus, the Republic of Moldova and Ukraine dropped much less and remains higher in the total GDP.

the largest component of major environmental pressures from human activities:

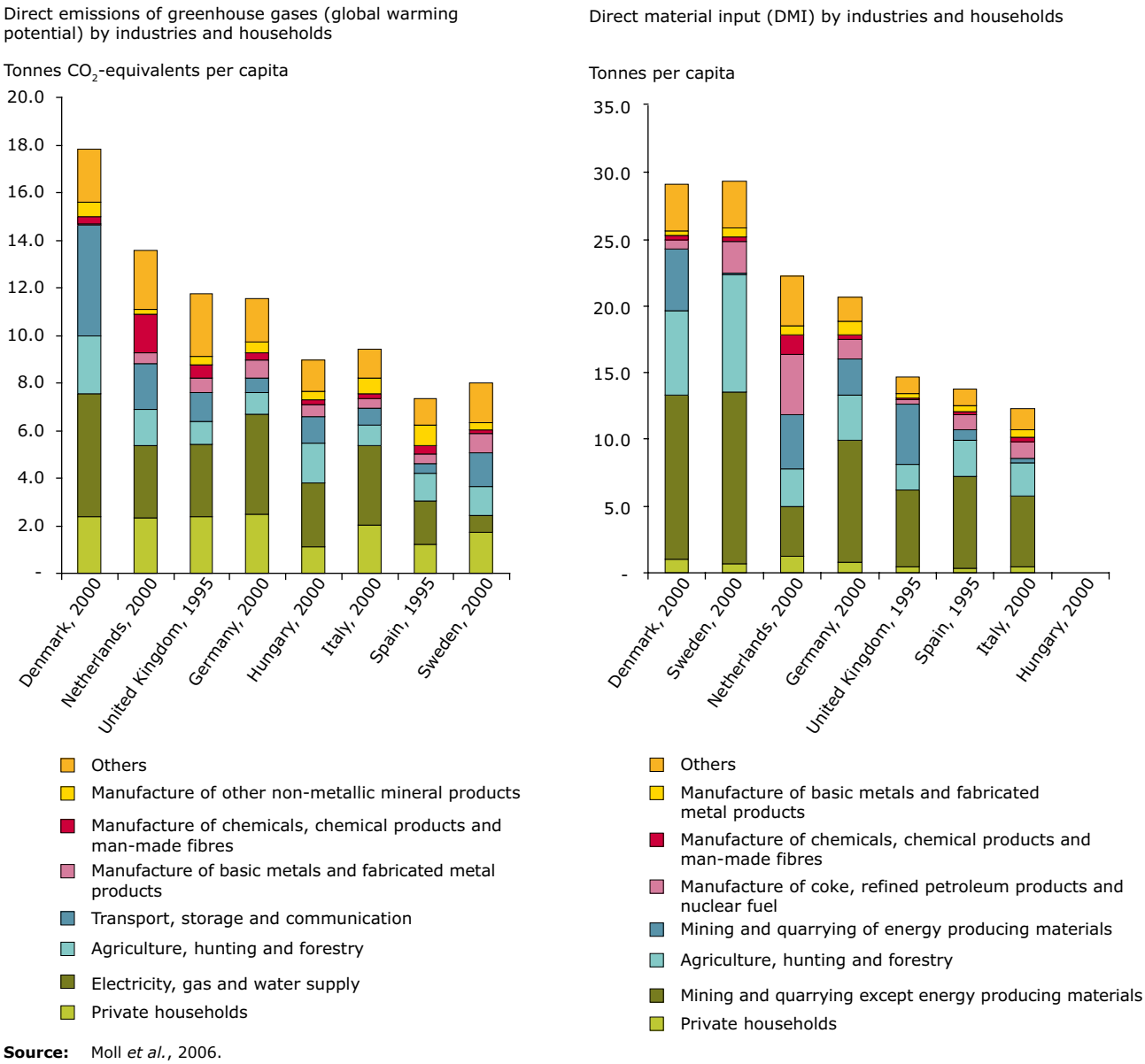
- combustion processes
- solvent use
- agriculture
- metal extraction and refining
- dissipative uses of heavy metals
- housing and infrastructure
- marine activities
- chemical industry.

For comparison, priority consumer products that cause the greatest environmental impacts include food and drink (meat and meat products, followed by dairy products), private transport (mainly cars), and housing (construction, energy and heating) (see Section 6.3, Consumption for details).

Priority resources

Another way to target policy action is to identify those types of resource use which cause most environmental impacts. A comprehensive study

Figure 6.3 Priority economic sectors generating significant environmental pressures



Source: Moll *et al.*, 2006.

Box 6.1 Growth of pollution-intensive industries in EECCA

In the early 1990s, it was widely believed that economic reforms in the EECCA region would promote a more efficient use of resources and energy, thereby reducing environmental problems. Indeed, in those sectors that were economically profitable and managed to attract foreign investments, such resource gains did occur and environmental impacts per unit of production decreased. However, it was the highly pollution-intensive industries — such as non-ferrous and ferrous metals, electricity generation, oil refining, coal and gas extraction — which kept growing. In the same period, there had been a significant decline in the less resource and pollution-intensive branches of industry. Less polluting industries (e.g. machinery and metalworking, light industry, timber and pulp), which were no longer receiving state support, lost internal markets and were unable to attract investment to compete internationally. As a result, some of those have declined and, in some cases, have ceased to operate.

Source: Cherp and Mnatsakanian, 2003.

for the EU-25 and three SEE countries (Bulgaria, Romania and Turkey) used a calculation of both mass flows ('how many tonnes are used?') and impacts per unit weight ('how harmful is each tonne?') to combine information on material flows and the life-cycle impact assessment (van der Voet *et al.*, 2004). The ten material categories with the highest environmental impacts were:

- animal products
- crops
- plastics
- oil for heating and transport
- concrete
- hard coal for electricity
- brown coal for electricity
- iron and steel
- gas for heating
- paper and board.

The preliminary 'priority' lists above reflect the situation in the EU Member States. The environmentally critical sectors in the EECCA countries are expected to be similar, although the impacts from the mining and extraction industries will be higher there than in the EU (see Box 6.1).

Production of metals and industrial minerals is important due to the environmental damage it causes. Such production tends to be associated with high consumption of resources. The ratio between unused and used extraction may range from less than 10:1 (for iron and aluminium), through more than 100:1 (copper), 6 000:1 (zinc) and up to about 1 000 000:1 for gold and diamonds. In addition to the high amounts of mining and quarrying waste, some of the waste may be highly toxic and a risk to the local environment (see Box 6.2).

6.2.2 International trade and shifting of environmental impacts

As a result of global trade, environmental impacts of a particular product or resource may occur in

Box 6.2 Kumtor gold mine — resource extraction and environmental risks

Since the independence of Kyrgyzstan, its rich gold reserves have attracted the attention of foreign investors. The largest investment was made in the Kumtor gold mine, located 4 000 meters above sea level in the permafrost and glaciers of the Tien-Shan Mountains. The Kumtor area is estimated to be the eighth largest goldfield in the world, and accounts for nine percent of Kyrgyzstan's GDP. In 2002, Kyrgyzstan produced about 18 metric tonnes of gold.

However, gold mining is an industry particularly damaging to natural ecosystems in the mining regions and causes significant man-made changes to large surrounding areas. In the Kumtor area, more than 3 000 hectares of land are directly damaged by mining activities. Piles of residues (tailings) — containing nearly 100 million m^3 of waste (2 million m^3 of which is radioactive) — are located in areas prone to natural disasters such as earthquakes and landslides. High amounts of cyanide-containing wastes are also a problem in other countries, including Ararat in Armenia, Navoi in Uzbekistan, Kriviy Rig in Ukraine and others.

Damage to the local environment may also result from accidents. Highly toxic cyanide is often used in gold extraction, and stringent safety measures are required at all stages of the process to protect workers and environmental health. Excessive concentration of cyanides in water near gold mines has been identified as a problem in Armenia, Georgia, and Kyrgyzstan among others (UNECE, 2007). Industrial accidents involving cyanide compounds are particularly dangerous, especially in those cases when water bodies are affected.

several countries. In the second half of the 20th century, global trade grew by a factor of 6 to 8 for raw materials, and by as much as 40 for finished and semi-finished goods (WTO, 2006).

All European countries have experienced a significant growth in imports and exports since the 1990s. In the EU-25 as a whole, the contribution of imports and exports to GDP grew from 27 % in 1990 up to 33–34 % in 2005. Exports are also one of the main drivers of economic growth in the Member States of EU-15. In the three largest SEE countries (Bulgaria, Romania and Turkey), the export component of GDP increased from 16 % to 31 %, while the contribution from imports was even higher, having grown from 21 % to 35 %. In the countries of EECCA the contribution of imports to GDP grew from 20 % to 29 %, and from exports from 20 % to 39 %.

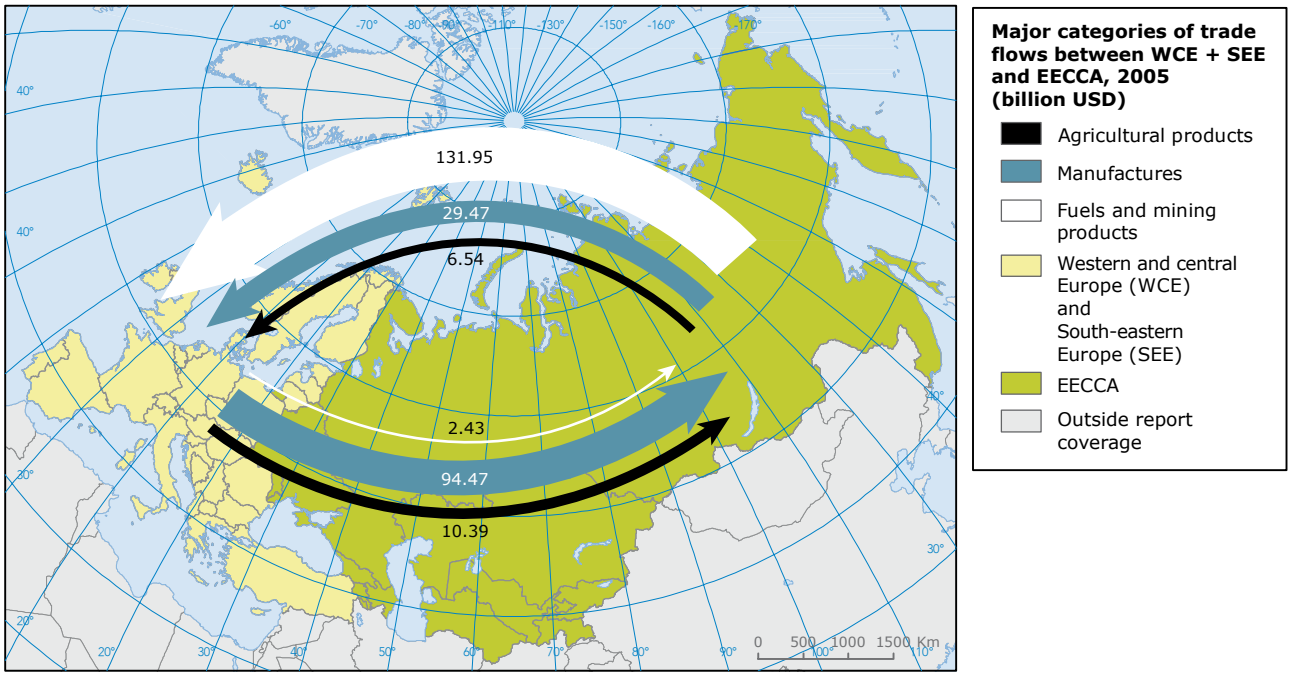
There is a significant asymmetry in the trade flows between WCE and SEE on the one hand, and EECCA on the other (see Map 6.1). The main flow from WCE and SEE countries to EECCA was in manufactured goods. Meanwhile, the EECCA countries predominantly exported to WCE and SEE fuels and mining products, which accounted for almost 80 % of the exports in 2005.

In the EU-15, almost four tonnes of fossil fuels are consumed per capita every year, most of which is imported from EECCA. Fuel is the fastest growing export category from EECCA (see Figure 6.4) since the period 1992–2004 when exports of mineral fuels from EECCA to EU-15 increased by more than 400 %. Exports of biomass, minerals, and metals showed significant but lower increases.

The greatest rise in imports into the EU-15 was from EECCA, although those from the EU-10 also more than doubled over the last decade. Imports of metals and biomass products from EU-10 grew by more than 250 %. Imports of semi-manufactured products of iron and steel dominated the overall increase between 1992 and 2004 whilst the increase in biomass imports was mainly related to wood and wood products.

Steel production is a good example of the specialisation of the economies. Although WCE,

Map 6.1 Trade flows between Europe and EECCA, 2005



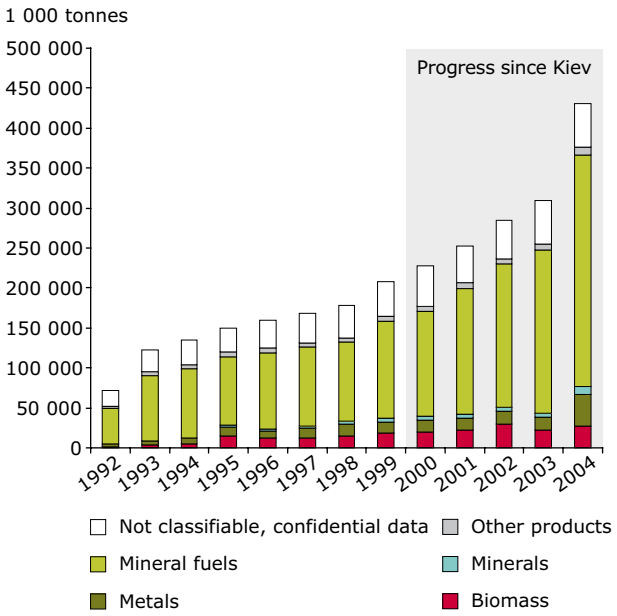
Source: EEA-ETC/RWM calculation based on World Trade Statistics, 2006.

with the exception of Sweden, imports almost all its iron ore, it is one of the biggest users of iron ore worldwide and is a net steel exporter. The processing of steel tends to take place at the 'high-tech' end of the production chain, resulting in specialised high-value steel products. By contrast, EECCA countries (the Russian Federation, Ukraine and, to a lesser extent, Kazakhstan), with rich deposits of iron ore and plentiful sources of energy, tend to process and export crude steel.

Raw material extraction and low-level processing are associated with high environmental pressures including contamination of air, soil and water, as well as landscape destruction, bringing with it threats to biodiversity. International trade, therefore, leads to the shifting of environmental burdens from the consumer countries abroad, since significant environmental damage occurs in the exporting countries.

Resource-exporting countries also run the risk of developing into 'single-engine economies', where economic growth is based on only one dominant sector, such as extraction of natural resources. This makes an economy highly vulnerable and in the long run, countries may prefer to diversify their economies and build up manufacturing capacities and services (see Box 6.3).

Figure 6.4 EU-15 imports from EECCA, 1992–2004



Source: Eurostat/COMEXT, 2005.

Box 6.3 Single-engine economies

Some experts argue that having large reserves of a highly demanded natural resource can be detrimental to the development of a diversified and healthy economy. Increasing reliance on income generation from resource extraction — be it oil, natural gas, or metal ores — may result in more capital being invested there. This can be at the expense of other sectors. As the dominant sector becomes more effective at what it produces and generates even more income, it draws resources away from the development of other areas (hence, the 'single-engine economy').

Proven oil reserves for the entire Caspian Sea region — estimated to be between 18 billion and 35 billion barrels in 2003 — are comparable to those of the United States (22 billion barrels) and greater than those in the North Sea region (17 billion barrels). The foreseen oil boom is associated with potential economic risks and may weaken other sectors. This was the experience in the Netherlands in the 1970s, when investments into the oil and gas sector were diverted from other industries, leading to economic stagnation.

While this scenario proves true in many cases, the example of Norway shows that it need not be the case. Norway extracts four times more natural resources, mainly oil and gas, than it uses within its own economy. It has, however, a highly developed and diversified industry. Moreover, it also enjoys an advanced social welfare system financed through a fund receiving taxes from oil extraction. This ensures that the benefits from oil extraction are equally distributed within the population. As a result, Norway is one of the richest countries in the world, with a GDP per capita of USD 39 200 (constant 2000 USD). This contrasts strongly with another oil exporting country: Kazakhstan, with a GDP per capita of USD 1 800 (constant 2000 USD). Kazakhstan has a very limited manufacturing and service capacity, lower social security and education standards and a rather asymmetric income distribution. However, it has started to develop a fund system based on the Norwegian model.

Sources: World Bank, 2005; Cherp and Mnatsakanian, 2003; US Geological Survey, 2004.

6.2.3 Resource use across the pan-European region

There are large differences in per capita resource use in individual countries across WCE, and also in the efficiency with which these resources are used. Differences are even greater if comparisons are made amongst countries across the whole pan-European region.

Per capita resource use

The only resource-use indicator available for nearly all countries within the pan-European region is the Domestic Extraction Used (DEU) index ([4]). The DEU totals all biomass, fossil fuels, metals, industrial minerals and construction minerals which are extracted within a country's territory and used in the economy.

A comparison of DEU per capita in the four regions over the period between 1992 and 2002 is shown in Figure 6.5.

In 2002, per capita DEU within WCE was about 14 tonnes in EU-10, and 17 tonnes in EU-15 + EFTA. The use of resources changed little during the period from 1992 to 2002, which indicates a weakening of the connection between use of resources and economic growth (or 'relative decoupling', as explained later in this section). The slight growth in resource use within EU-10, despite the closure of heavy industries, was largely due to the increase in construction activities.

Meanwhile in the EECCA countries, DEU per capita went down from 17 tonnes in 1992 to 13 tonnes in 1997, with a slight recovery to 14 tonnes per capita by 2002. This recovery was mainly due to a rise in extraction of fuels and metals, following an economic recovery in the late 1990s. In SEE, the DEU per capita at about 8 tonnes is much lower and is still slowly declining.

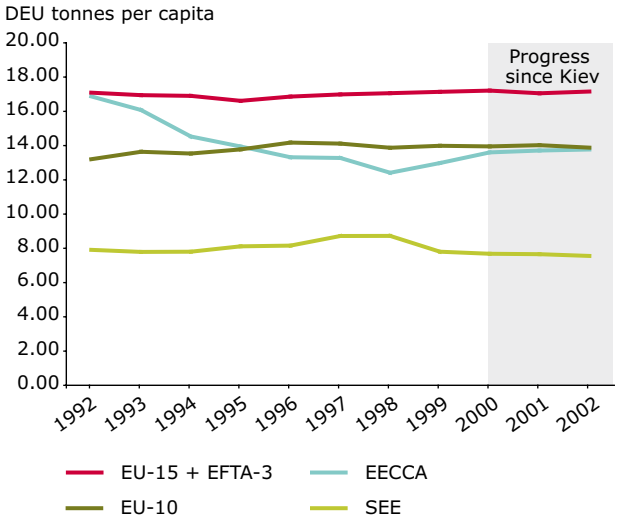
In EU-15 + EFTA and SEE, and increasingly in EU-10, the strongest demand for resources comes from construction projects. In EECCA, demand is highest in the extraction of fossil fuels and metals.

In 2002, use of industrial and construction minerals ranged from over 10 tonnes per capita in the EU-15 to about 2 tonnes in EECCA (Figure 6.6). Growth in this category was fastest in EU-10 and EECCA, due to the increase in construction activities. In the case of metals, EU-15 had a very low domestic metal extraction rate of about 0.2 tonnes per capita, compared with about 2 tonnes per capita in EECCA. Extraction of fossil fuels was the highest in EECCA and EU-10, and relatively low in EU-15 and SEE. Finally, the highest biomass extraction per capita was in EECCA and in SEE, compared with the much lower estimates for EU-15 + EFTA and EU-10. The figures above indicate quite a different pattern of resource use across the regions and countries.

Efficiency of resource use

Differences between countries are even greater when comparing how efficiently they use resources. Efficiency of resource use can be examined by relating Domestic Extraction Used to Gross Domestic Product (see Figure 6.7).

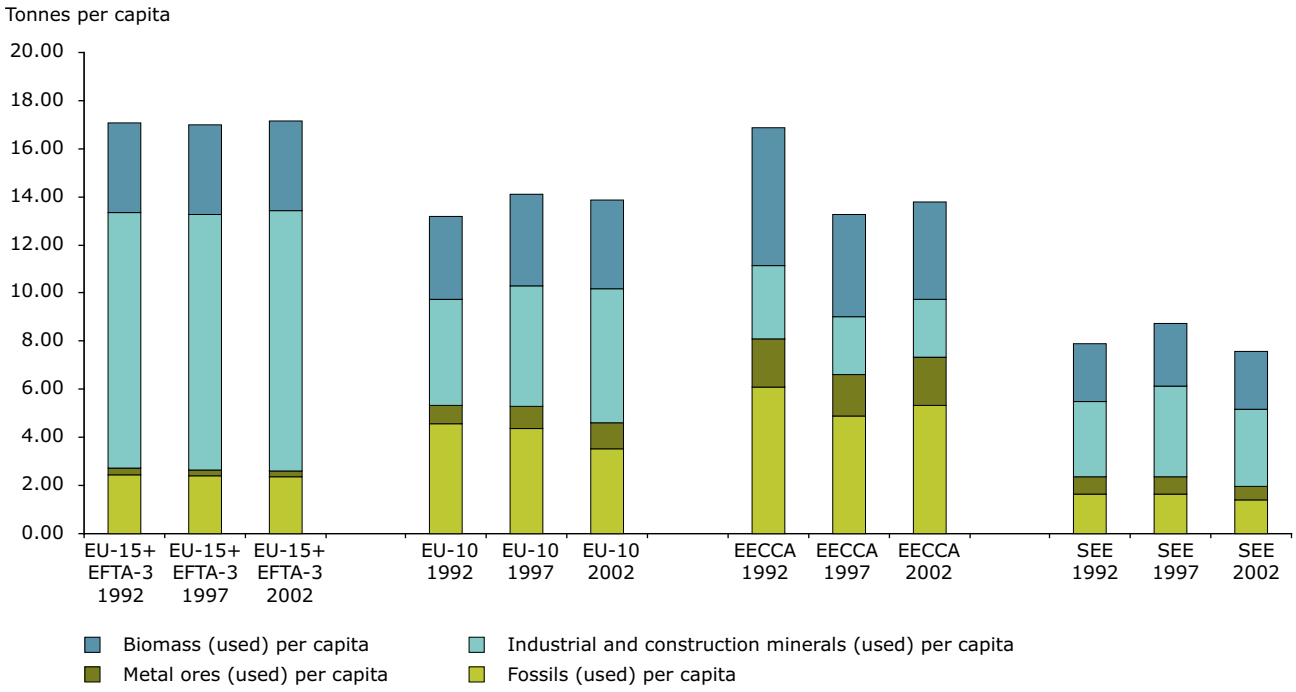
Figure 6.5 Domestic Extraction Used (DEU) per capita



Source: MOSUS, 2006.

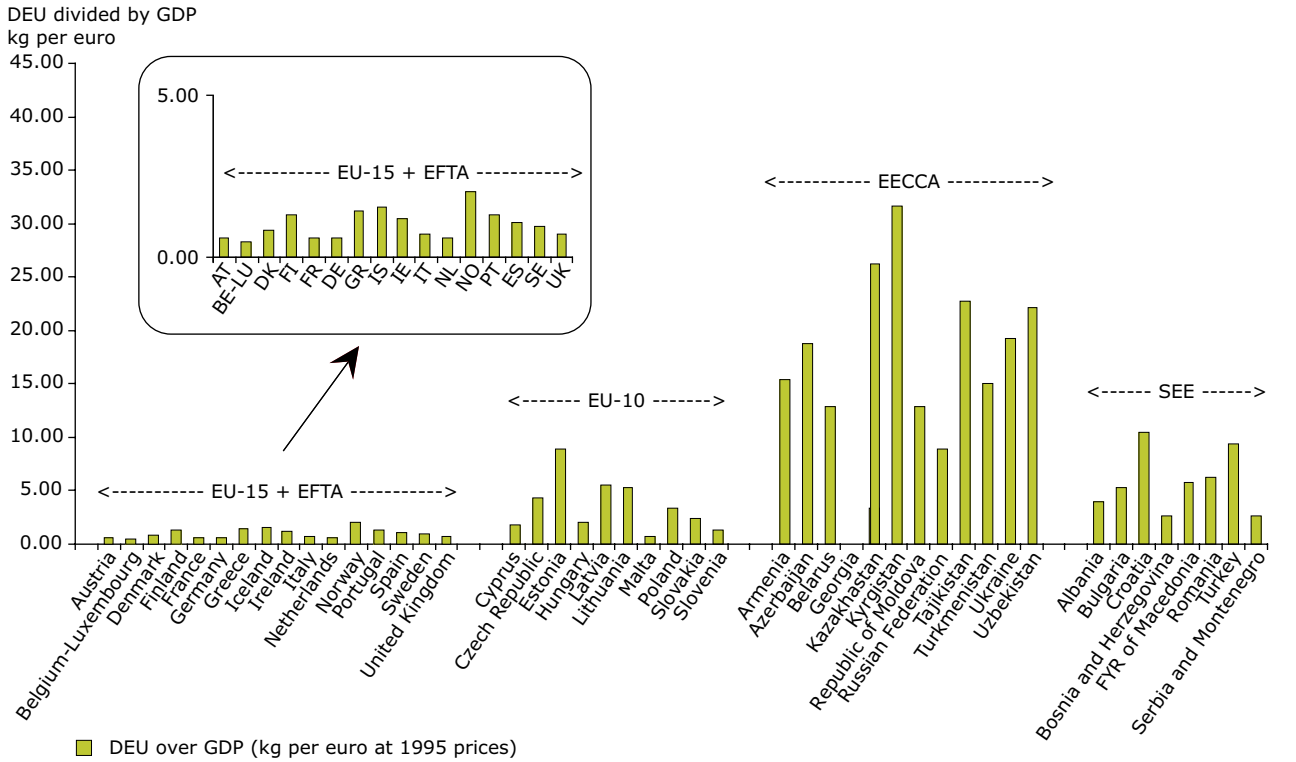
([4]) A whole system of Material Flow Accounting (MFA) exists to describe material use in the economies (EEA, 2005a). The most commonly used MFA indicators are DMI (Direct Material Input), DMC (Domestic Material Consumption) and TMR (Total Material Requirement). Compared to DEU, the three above indicators take into account aspects such as imports, exports, and 'ecological rucksacks' of imported goods. However, these indicators are available only for Members of the European Union. Therefore, to ensure comprehensive geographical coverage, DEU is used as the material use indicator in this chapter. While its limitations concerning imports and exports need to be kept in mind, the difference between DEU and DMI is usually only a few percent.

Figure 6.6 Breakdown of resource use per capita by category



Source: MOSUS, 2006.

Figure 6.7 Domestic Extraction Used (DEU) over GDP, 2000



Sources: Wuppertal Institute, 2005; Eurostat, 2004; van der Voet *et al.*, 2004; MOSUS, 2006.

The efficiency of domestic resource use is the highest in the EU-15, with a median value ([5]) of about 0.8 kg per euro. The EU-10 have a lower efficiency at 2.9 kg per euro and there are also large differences between individual countries. The economies of the three Baltic states, the Czech Republic and Poland are much more resource-intensive than the rest of this group.

The resource efficiency of SEE economies is lower still, with a median resource intensity of 5.6 kg per euro. By far the highest use of resources compared to GDP is in the EECCA region, with a median value of 17.1 kg per euro. However, very large differences between countries are found within this group, where the values range between 3 kg DEU per GDP in Georgia to 26 kg in Kyrgyzstan.

Overall, the average efficiency of resource use is up to twenty times higher in the EU-15 than it is in EECCA. Even taking into account such differences between the countries as climate, geography and structure of their economies, there are still vast opportunities for increasing efficiency in the use of materials and energy.

Despite their much higher efficiency of resource and energy use, the ecological footprint of EU-15 was significantly higher than in the other regions and more than twice the 'sustainable' level. EU-10 and SEE also operated on unsustainable levels, although to a lesser degree. Only the EECCA region was using resources without running an 'ecological deficit' — thanks to their large land areas and high available bio-capacity (see Chapter 1, Europe's environment in an age of transition).

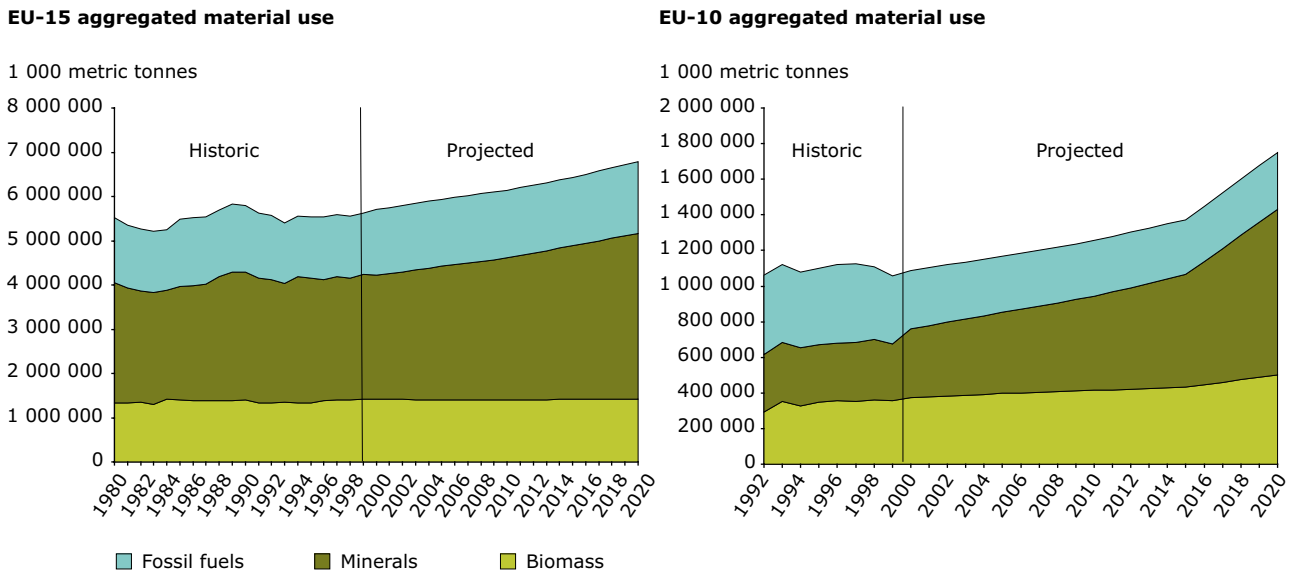
Outlook for resource use and sustainability

The need, and the opportunity, to improve efficiency of resource use is all the more evident when looking at the projections of future resource use (see Figure 6.8).

In EU-15, the use of resources in 2000 was about 5.7 billion tonnes. It is expected to grow up to about 6.8 billion tonnes by the year 2020, an increase of about 19 %. Use of minerals in the construction industry is expected to account for most of the growth.

In 2000, EU-10 were using just over 1 billion tonnes of resources. It is projected that consumption

Figure 6.8 Aggregated material use, historic and projected, in EU-15 and EU-10



Source: Skovgaard *et al.*, 2005.

([5]) The median value identifies the middle of a distribution, i.e. 50 % of data points lie below and 50 % lie above the median. The median is more useful than the average (mean) when differences between individual countries under comparison are very significant, which is the case here.

will grow to almost 1.7 billion tonnes in 2020, an increase of some 60 %. Use of fossil fuels will decline, thanks to improvements in energy efficiency and fuel switching. On the other hand, biomass extraction will increase by about 35 %, while the use of minerals is expected to grow by 140 %, owing to various infrastructure construction projects.

6.2.4 Policy responses

Sustainability

Sustainable use of resources needs consideration of their availability, the security of their supply, and safeguarding productive capacities of ecosystems. At the same time, it is important to maintain the ability of the environment to act as a 'sink' to absorb emissions and pollutants. Increasing sustainability in production will require improvement in production efficiency, innovative technical and managerial approaches and better environmental monitoring and control.

The need for sustainable management of resources, whilst delinking environmental impacts from economic growth and increasing eco-efficiency of production, has become much more prominent on the EU policy agenda (see Box 6.4). As far as the EU is concerned, this is not a radical step, but part of an ongoing process of policy development. Policy has been evolving from a focus on the end-of-pipe technologies during the 1980s, through more preventive environmental strategies in the 1990s, to the recent drive to reduce impacts during the entire life-cycle of products and services.

Decoupling

One of the recent objectives of environmental policy in Europe is to achieve 'decoupling'. This means breaking the link between economic growth, and the use of resources and energy with their related environmental impacts. Addressing the issue of the use of natural resources, the May 2003 Kiev Declaration of Environment Ministers set out to:

... encourage national efforts to promote sustainable production and consumption as well as corporate environmental and social responsibility and accountability. ... The delinking of economic growth and environmental degradation, so as to promote both economic growth and environmental protection is crucial.

In the past, the link between economic growth and environmental impacts was strong. In the twentieth century, the global GDP increased 19-fold, while the global consumption of energy grew 18-fold over the same period. Similarly significant growth took place in the amount of natural resources used by the economies. Decoupling pre-supposes that the consumption of resources or energy and the related environmental impacts need not grow when the economy expands.

Relative decoupling occurs when an environmental pressure continues to grow although at a slower rate than the economy. Whether a relative

Box 6.4 Policy initiatives on sustainable use of resources in the European Union

In 2005, the EU launched thematic strategies on sustainable use of natural resources and on prevention and recycling of waste. The renewed EU Sustainable Development Strategy, adopted in June 2006, identifies conservation and management of natural resources, and sustainable consumption and production, among its seven key challenges. It also identifies corresponding targets and operational objectives (European Council, 2006). The 6th Environment Action Programme of the EU, revised in 2007, places a special emphasis on the need for the EU to carry out its social and economic development within the carrying capacity of ecosystems. Breaking the link between economic growth and the environmental impacts of resource use, consumption and waste remains an essential concern. Particular attention will be paid to the sectors responsible for the greatest use of resources, and to areas where implementation gaps have been identified. EU set itself a target of becoming the most resource-efficient economy in the world (European Commission, 2007c). As part of this objective, in 2006 the European Commission set up, jointly with UNEP, an International Panel on Natural Resources. The EU is also developing an Action Plan on Sustainable Consumption and Production.

Despite such policy commitments, only a handful of countries within the EU-25 have adopted national plans or targets on sustainable use of resources, eco-efficient production and decoupling. The developments in this area include setting of decoupling targets in Austria, Denmark, Germany, Italy, the Netherlands, Poland and Portugal, and developing national SCP policies in the Czech Republic, Finland, Sweden and the United Kingdom. So far, no countries outside WCE have adopted such policies.

decoupling results in decreased environmental impacts is an open question, as it can be achieved even when the use of resources or energy continues to grow. Absolute decoupling takes place when the environmental pressure decreases in absolute terms, while the economy continues to grow. For example, by closing down heavy industry, total waste generation in the EU-10 over the last decade has decoupled from economic growth (see Section 6.4 for more detail).

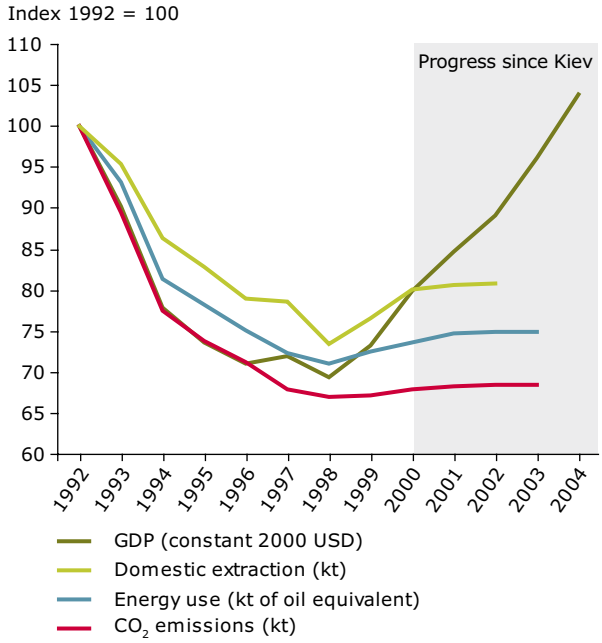
In the EU-25, a relative decoupling between economic growth and energy and material consumption has been achieved in some areas, although some of this decoupling may be due to increasing imports to compensate for the decline in domestic production or extraction. In the most environmentally critical industrial sectors of the EU, air emissions, such as acidifying substances and chemicals that deplete stratospheric ozone, have decreased whilst production has increased or remained constant. In the case of greenhouse gases (CO_2, N_2O and CH_4), decoupling has been less pronounced but some improvements have been achieved through end of pipe technologies and by switching to natural gas.

In EECCA, relative decoupling has been witnessed in relation to energy consumption and extraction of raw materials (Figure 6.9).

Between 1992 and 1998, EECCA's GDP, at constant prices, fell by about 30 % and their resource use also fell over the same period. However, from the late 1990s, their economies have been growing steadily, and by 2004 several countries regained GDP levels of the early 1990s. By contrast, energy use and raw material extraction have grown at a slower rate. Strongest decoupling was achieved with respect to CO_2 emissions, which after 1998 stabilised at about two-thirds of the 1992 levels.

This relative decoupling has been achieved through a combination of factors. The move from heavy industries to services, better environmental controls and improved efficiency of using resources and energy have all played a part. Nonetheless, there is still potential for further improvements in resource-use efficiency so that absolute decoupling can be achieved in the coming decades.

Figure 6.9 Relative decoupling of resource use and CO_2 emissions from economic growth, EECCA



Sources: World Bank, 2005; MOSUS, 2006.

Life-cycle thinking

Today's environmental policies are increasingly based on life-cycle thinking. A life-cycle approach identifies the negative environmental impacts produced by the use of materials and energy throughout their life (often referred to as the 'cradle to grave' approach) and determines their respective significance.

The EU Thematic Strategy on the Sustainable Use of Natural Resources is a good example of how, by considering the whole life-cycle of a product, this approach prevents impacts shifting from one life-cycle stage to another, one place to another or from one environmental medium to another (see Box 6.5). If global and cumulative impacts are understood as a cause-and-effect chain it is possible to identify policies that are both effective for the environment and cost efficient.

Role of innovation

As countries develop and the wealth of their citizens increases, so does their impact on the environment. Effectively this means that Europe, together with other developed nations, must be prepared to

Box 6.5 Thinking in life-cycle terms and the control over pollution

One example of life-cycle impacts is the use of the catalytic converters in car exhaust systems. The technology, based on the use of platinum and palladium, has helped to reduce hazardous air emissions and improved air quality in cities across the EU.

WCE imports 14 % of its total requirement for platinum group metals (PGM) from EECCA countries. Most of it comes from the Norilsk Nickel Enterprise production facility in the town of Norilsk in Siberia. Here, nickel, copper and PGM are extracted in the form of sulphides. During the smelting, converting and refining, sulphides are oxidised into SO_2, which is emitted in large quantities into the atmosphere. In 2004, the emissions of SO_2 attributed to PGM production were estimated at 4 275 tonnes of SO_2 per tonne of PGM. This amounts to 120 384 tonnes of SO_2 for the total of the Russian export of PGM to Europe. This was comparable to the total direct SO_2 emissions of Slovakia in 2003 (106 096 tonnes) and was equivalent to a quarter of the direct SO_2 emissions in France in 2003. The continuous emissions of acidifying substances have led to a widespread change in soils and vegetation around the facilities and are causing health problems among the local population.

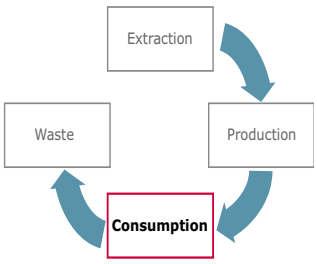
Significant amounts of SO_2 were also emitted from two other large facilities of Norilsk Nickel located in the Kola Peninsula, negatively affecting the environment in the Scandinavian countries. In response, the management of the company has announced significant investments in cleaner technologies, with a significant part of funding provided by the Nordic countries.

reduce their use of resources through efficiency and innovation.

Many innovative technologies already exist, but lack of investment, both in further development and marketability, hampers their wider adoption. Moreover, in many cases the choices of today will affect Europe for many decades to come. Europeans may be able to change their cars or washing machines every decade or so, but the life spans of other products are much longer and therefore will be slower to change. New roads built today are likely to last 20–50 years; power stations are built for 30–75 years depending on their type; commercial and government buildings, 50–100 years; and homes, railways and hydro-electric dams up to 150 years (GFN, 2006).

The range of life-spans emphasises the policy choice. What Europe invests in today can either lock its citizens, and future generations, into unsustainable lifestyles with an ever increasing use of natural resources, or encourage a sustainable and economically competitive alternative.

6.3 Consumption



As incomes rise so does consumption and demand for more food and beverages, for larger, warmer and more convenient living spaces, for appliances, furniture and cleaning materials, for clothes, transport and energy. Given that the consumption by households is three to five times that of governments, this section focuses on household consumption.

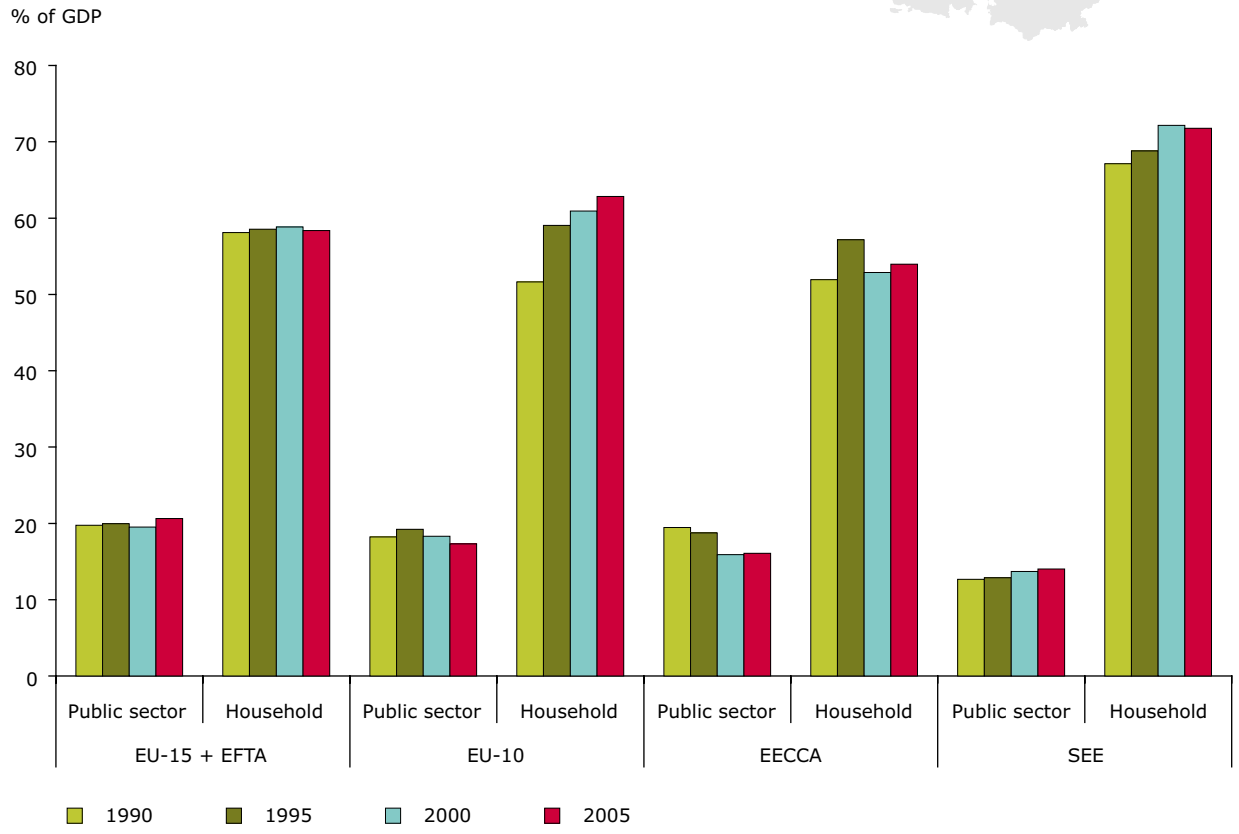
In Europe, the affluence of the majority of the population has moved them beyond consumption patterns dictated by need alone, and even, for some products and services, beyond convenience and in many cases beyond environmental sustainability. Recognising the need to alter consumption patterns and behaviour, the Kiev Declaration calls for the environmental impacts of consumption and production to be decoupled from economic growth. Mechanisms exist, but progress towards their introduction remain slow within the pan-European region.

6.3.1 Consumption trends and characteristics

Household and public sector consumption

Household and public sector consumption remain closely linked to GDP in all country groups in the pan-European region (Figure 6.10). Expenditure by households is between three and five times higher than by the public sector in EU-15 and SEE respectively. This section therefore analyses the drivers and environmental pressures from household consumption and the instruments that can be used to influence them.

Figure 6.10 Household and public sector consumption as a percentage of GDP



Source: World Bank, 2007.

Patterns of household consumption are shaped by a large number of interdependent economic, social, cultural and political driving forces. Most significant in Europe are: increasing incomes and growing wealth, globalisation of the world economy with the opening of markets, increasing individualism, new technologies, targeting of marketing and advertising, smaller households and ageing populations in some regions (EEA, 2005b).

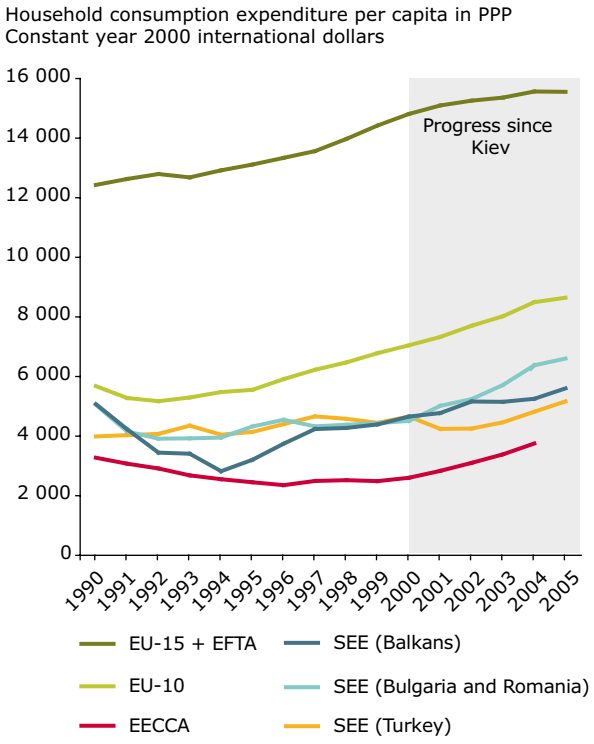
Populations are relatively stable over the region as a whole, although they are currently falling in the Russian Federation and Ukraine and rising in Central Asia and Turkey (see Chapter 1). Changes in population therefore do not currently have a major role in shaping consumption. However, in the EU, the Russian Federation, Belarus and Ukraine, the number of people per household is declining, whilst the average dwelling area is increasing ([6]). This has led to an annual increase in the total living space by approximately 1 % in these EECCA countries and 1.3 % in the EU, which tends to promote increasing per capita energy consumption for domestic heating.

Levels and distribution of household consumption

In WCE, total household consumption expenditure per capita increased 25 % between 1990 and 2005, and is significantly higher than in the other regions — approximately four times the average in EECCA (Figure 6.11). In many SEE and EECCA countries, household expenditure recovered to 1990 levels for the first time only in 2002 or 2003 after the economic restructuring of the 1990s. However, although EECCA is still the region with the lowest

([6]) Enerdata, 2005; Enerdata, 2006; CISSTAT, 2006.

Figure 6.11 Household expenditure per capita



Source: World Bank, 2007.

per capita expenditure, in recent years expenditure has been increasing rapidly at around 8–10 % per year.

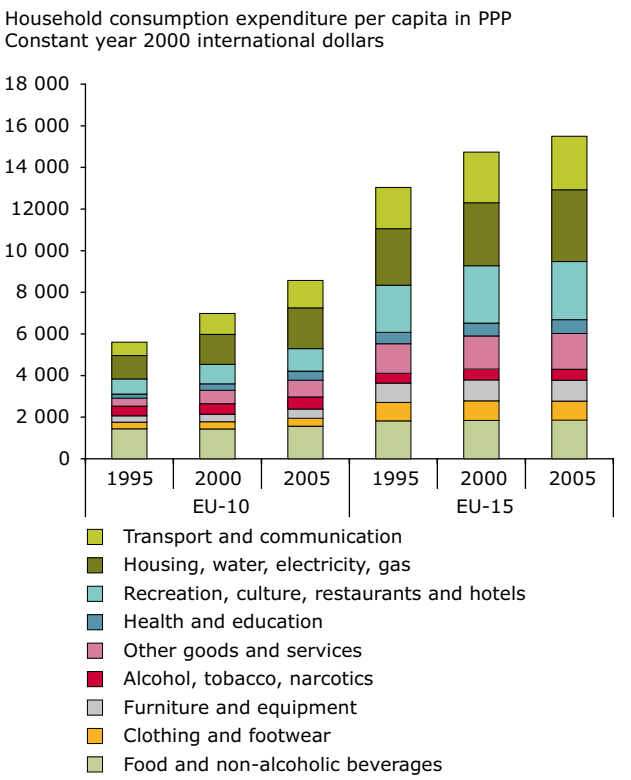
Across the EU-25 , expenditure on food has remained constant even with increasing incomes, and thus presents an ever decreasing proportion of overall expenditure, from 14.4 to 12.5 % between 1995 and 2005 (Figure 6.12). Transport and communication, housing (including utility payments), recreation, health and education are the fastest growing expenditure categories. In EU-15, recreation now represents the second largest area of household spending. Consumption patterns in EU-10 are moving closer to those in EU-15, reflecting a change in lifestyles and a general increase in disposable income.

The limited data available for SEE show that the proportion spent on food is decreasing but is still over 30 % in most cases. This is followed by housing (including utilities) and transport expenditures.

While food and clothing still represent a high proportion of household expenditure across the EECCA countries (Figure 6.13), they decreased in relative terms from 65 % to 48 % following the end of the recession. Overall income grew by 80 % over the same period. This increment was used progressively on housing and utilities, transport and communication, home appliances and recreation. Spending on recreation, although still modest, increased by a factor of five between 2000 and 2005.

In the less developed countries of Central Asia and the Caucasus, food dominates household expenditure. This is particularly true of rural areas where there is little or no surplus income for non-essentials. In Tajikistan and Azerbaijan, food represented 64 % and 54 % of expenditure in 2005, down from 87 % and 76 % in 1996. In many

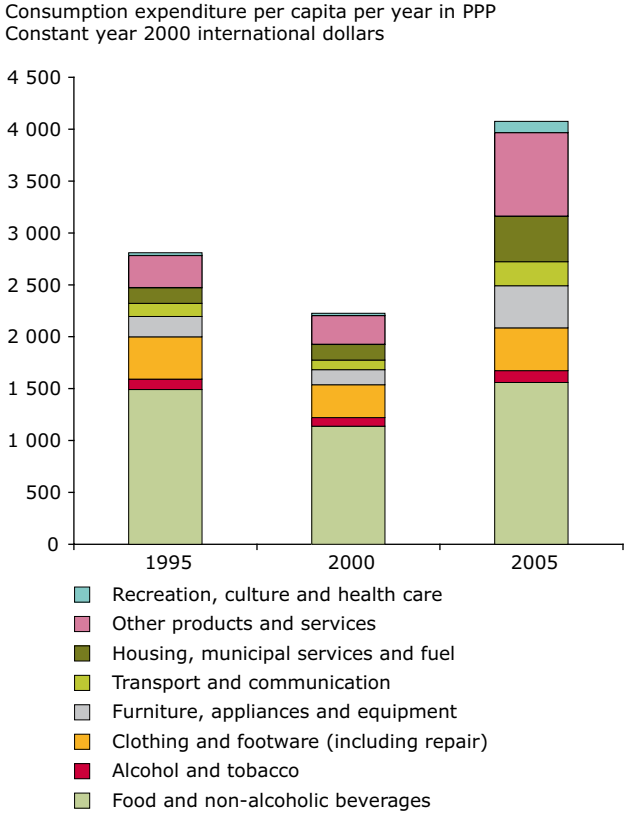
Figure 6.12 Changing household consumption patterns in EU-10 and EU-15



Note: Sectors are presented in the order of most rapidly growing in EU-15.

Sources: Eurostat, 2007a; World Bank, 2007.

Figure 6.13 Changing household consumption patterns in EECCA



Note: Sectors are presented in the order of the most rapidly growing.

Source: CISSTAT, 2006. Covers all EECCA except Uzbekistan, Turkmenistan, all years; Georgia, 1995 and 2005; and Kyrgyzstan, 2005.

EECCA countries and in parts of the Balkans, the proportion of the population living below the poverty line is still significant (UNECE, 2006).

Economic growth since the late nineties is not benefiting all parts of society, and inequalities between urban and rural areas are high and increasing. In the Republic of Moldova and Georgia, for example, average household incomes in rural areas are 40 % and 55 % respectively of average household incomes in urban areas (World Bank Development Indicators). Furthermore, in a number of EECCA countries, there is evidence of a growing rich urban elite and urban middle class who are adopting the consumption patterns of WCE (Kilbinger, 2007; Vendina, 2007; Svinhufvud, 2005).

6.3.2 Impacts of consumption

Consumption categories with the greatest overall impacts

The European Commission-funded Environmental Impact of Products (EIPRO) project undertaken by the Joint Research Centre has identified those goods and services which have the greatest environmental impact when viewed across their full life cycle and summed up across total consumption for the EU-25 (European Commission, 2006b). The review of recent European studies ([7]) identified the following consumption categories as having the highest overall life-cycle impacts:

- food and beverages;
- private transport;
- housing, including heating and hot water, electrical appliances and structural work.

Together these areas of consumption account for 70 % to 80 % of environmental impacts, and 60 % of consumption expenditure.

These results are consistent with EEA's findings (EEA-ETC/RWM, 2006a) on environmental impacts from production and consumption using integrated environmental and economic accounting for eight EU countries. This study identified economic sectors which cause the highest environmental impacts (see Section 6.2.1).

Economy-wide analysis of impacts is yet to be carried out in EECCA and SEE. However, based on comparison of household expenditure patterns, it is expected that similar consumption categories are also of concern.

The EIPRO and EEA studies do not differentiate holiday from home consumption. Other studies, however, have identified tourism including air travel as an important and rapidly growing

([7]) Dall *et al.*, 2002; Nemry *et al.*, 2002; Kok *et al.*, 2003; Labouze *et al.*, 2003; Nijdam & Wilting, 2003; Moll *et al.*, 2004; Weidema *et al.*, 2005.

household consumption area, with respect to its overall impact in EU (Lieshout *et al.*, 2004; EEA, 2005b) (see also Sections 7.2, Transport, and 7.4, Tourism). In EECCA and SEE, tourism and air travel currently do not represent a significant expenditure category.

A number of these key areas of consumption (with the exception of tourism, covered elsewhere in this report) are considered in more detail below.

Changing consumption patterns, decoupling and regional differences in impact

Changing consumption patterns can aid the decoupling process by shifting consumption from high to low impact-intensive ([8]) goods and service categories. While there has been a decoupling of domestic resource and energy use from economic growth in the EU (see Section 6.2), it is not clear which role changing consumption patterns have played. The decoupling may be largely due to increased production efficiencies and the shift of impacts abroad through economic structural changes in the EU.

The EU's EIPRO study ranked services and products in order of impact intensity with meat and dairy products, lighting and electrical appliances, heating, air transport and household furnishings being high on the list (European Commission, 2006b). Moreover, consumption of several of these high-impact categories, specifically transport, housing, furniture and appliances, are increasing rapidly rather than levelling off (Figure 6.12). Other more in-depth studies have also failed to find evidence of decoupling resulting from changing consumption patterns in EU Member States (Røpke, 2001).

As shown above, consumption expenditure is far lower in EECCA and many SEE countries than in WCE. However, the differences in impacts per capita are likely to be less marked. This is probably due to lower efficiency in production (Section 6.2) and consumption (for example low thermal efficiency of housing) in SEE and EECCA.

Food and beverages

The most significant environmental impacts of food consumption are indirect, and relate to the agricultural production and industrial processing. These include impacts from: energy, water use and waste generation in agriculture and the processing industry; the use of fertilisers and pesticides; emissions from livestock; land use and transportation. Direct impacts of food consumption are lower in magnitude and relate to travel for shopping trips, energy use for cooking and cold storage, and the production of organic and packaging waste (EEA, 2005b).

Expenditure on food across the region appears to be decoupled from growth in incomes and GDP ([9]) (Figures 6.12 and 6.13). In addition, agriculture has been undergoing efficiency improvements over recent decades. However, a number of trends in food consumption are partially offsetting these decoupling trends (Kristensen, 2004). Of key importance is a shift in demand from local and seasonal towards imported, non-seasonal fruit and vegetables, and a general globalisation of the food market. This increases transportation, cooling and freezing inputs with a corresponding increase in energy-related impacts.

Greater impacts result from increased use of processed foods and pre-prepared meals. This is driven by increasing wealth, smaller households and less free time for food preparation (Kristensen, 2004; Blisard *et al.*, 2002). Greater processing of food leads to increased energy and material input, and associated packaging waste (Kristensen, 2004).

A small but growing group of consumers in WCE are switching to organic and/or locally produced foods. Although organic food only represents 1–2 % of sales (IFOAM, 2006) in EU-15, demand in some countries is outstripping national supply, leading to rapid increases in imports ([10]). In EECCA and SEE, levels of artificial fertiliser and pesticides used in agriculture are significantly lower than in WCE. This suggests an opportunity for greater production and export of organic-labelled produce,

([8]) Impact per unit consumption.
([9]) Food and drink consumption is projected to grow 17 % between 2000 and 2020 in EU-15 compared to a projected 57 % increase in GDP (EEA, 2005b).
([10]) In Denmark, imports of organic food increased by 31 % between 2004 and 2005 due to lack of land for further organic farming.

and eventually a larger domestic market for organically grown food.

While the environmental consequences of food production and food safety have gained considerable attention in the EU, providing basic food remains a challenge in a number of countries in Central Asia and the Caucasus. Here, malnutrition remains prevalent although, since a peak in the mid-1990s, levels have fallen to less than 10 % of the population in all countries of the region except Tajikistan, Uzbekistan, Armenia and Georgia (FAOSTAT, 2006).

Heating and hot water

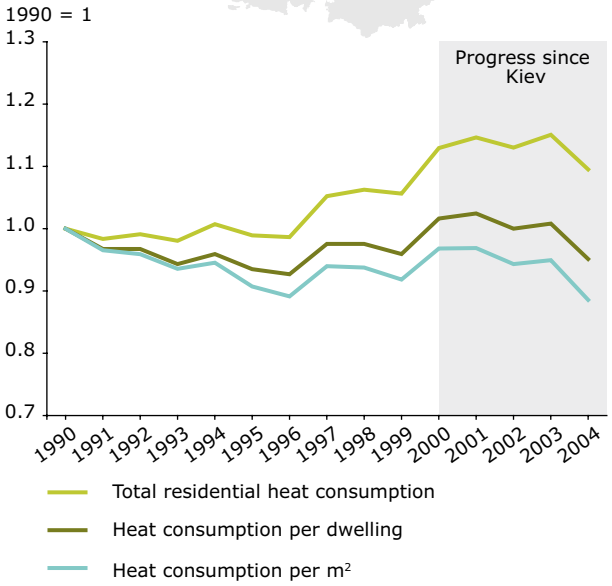
Space heating accounts for 70 % of household energy consumption in the EU-25 with water heating accounting for 14 % (Eurostat, 2007b). Similar proportions have been estimated for EECCA and SEE (UNEP/EEA, 2007). Heating is one of a number of consumption sectors in WCE where efficiency improvements have been more than offset by increased demand.

In most Member States of EU-15, the overall efficiency of interior heating of households has increased during the last 15 years, mainly through better insulation and heat-loss prevention. However, the growth in number of dwellings, floor area per dwelling and increased average room temperatures have more than offset these improvements (Figure 6.14 and Box 6.6).

In EU-10, and in Bulgaria and Romania, energy-efficiency improvements have been significant since 1990. Total energy use for interior heating has decreased, although energy use for heating per capita is still significantly higher than in EU-15.

In most EU-10, SEE and EECCA countries, there are two characteristics that have a decisive role in the overall environmental performance of household heating: the huge stock of poorly insulated panel-built apartment blocks ([11]) and a large proportion of urban population which is still connected to district heating systems where heat from combined heat and power stations ([12]) are often used. These two characteristics pose both an

Figure 6.14 Residential heat consumption, EU-15



Source: Enerdata, 2006.

Box 6.6 Efficiency improvements and the 'rebound effects'

Despite efficiency improvements, the overall energy consumption of households is increasing in the EU, due partly to rebound effects (changes in behaviour in response to technological efficiency improvements and lower prices (Hertwich, 2003)).

In the United Kingdom, for example, standards in building insulation have improved significantly. At the same time, however, increased insulation and fitting of central heating allow households to heat more rooms than they actually require and to higher temperatures. Average temperatures inside domestic dwellings (including unheated rooms) are estimated to have increased from 16 °C to 19 °C between 1990 and 2002 (DTI, 2005), offsetting energy savings from increasing thermal efficiency.

Similarly, it is expected that initiatives in EECCA, with the objective to improve the thermal efficiency of buildings (Box 6.7), will lead to increases in room temperatures rather than reduce heat use. In Central Asia and the Caucasus, many people currently only heat their houses to a limited degree due to the high cost of energy and low thermal efficiency of older buildings. Such energy efficiency improvements will clearly have strong positive health impacts (Lampietti and Meyer, 2002).

([11]) According to estimates, up to 170 million people reside in over 70 million apartments in panel-type buildings in EU-10, SEE and the eastern European part of EECCA (Csagoly, 1999).

([12]) District heating covers 60 % of heating and hot water needs in eastern Europe; in the Russian Federation, it accounts for over 30 % of total energy consumption.

opportunity and a challenge. Fitting such existing apartment blocks with improved insulation and greater levels of control over heat input can reduce energy requirements by 30–40 % (UNEP/EEA, 2007). Meanwhile, rationalisation of district heating systems and insulation of distribution networks would result in potential savings in the supply chain of up to 80 billion m^3 of natural gas annually across the EECCA region (IEA/OECD, 2004). This is equivalent to the annual natural gas consumption of Germany.

The main challenge in many of the countries in these regions is either lack of financing from municipalities or lack of tariff revenues where utilities have been privatised. This is often due to the inability of the average customer to be able to afford higher tariffs to fund the necessary investments. Lack of metering and control of heat consumption both at the building and individual apartment level give little incentive or ability for residents to save energy. However, there are increasing examples that demonstrate that the challenges can be overcome (Box 6.7).

Box 6.7 Reducing heat consumption in SEE and EECCA

In most district heating systems in the EECCA and SEE regions, heat losses are estimated to be in the range of 20 % to 70 %, although it is difficult to assess losses from the existing infrastructure. A large number of projects have demonstrated that difficulties can be overcome (see www.undp.org/energy/prodocs/rbec; UNEP/EEA, 2007; CENEf, 2001). One example is a partly internationally funded project in Gabrovo, Bulgaria during the late 1990s. This included: training of building energy efficiency experts, energy audits, energy-saving measures in district heating systems in public and residential buildings, installation of meters and heating controls in individual apartments, and a consumption-based tariff system. The project resulted in 27 % savings in heat consumption (UNDP, 2004). Other municipalities in Bulgaria have since followed this example. A similar project in Almaty, Kazakhstan, will place additional emphasis on activating and strengthening resident housing associations and environmental service companies to drive forward efficiency improvements at the building level (UNDP *et al.*, 2006). In the municipality of Kraljevo in Serbia and Montenegro, a rationalisation project financed by the Serbian Energy Efficiency Agency was carried out in an apartment block. The immediate saving during the first season is expected to be above 10 %, resulting from both improved efficiency and consumer savings, with a capital pay-back period of around 3.5 years (Simeunovic, 2006).

Building standards are of key importance for future consumption levels. A wave of new national and regional building standards and energy labels for buildings in the Russian Federation, Kazakhstan, Albania, Croatia, Tajikistan, Ukraine and Armenia among others have led to new buildings with thermal efficiencies 35–40 % greater than buildings constructed in the 1990s (UNEP/EEA, 2007). Buildings following the new standards represented 8 % of living space across the Russian Federation and 15 % in Moscow in 2005 (Iliychev *et al.* 2005). A number of countries, however, still use outdated thermal efficiency standards used in the former Soviet Union.

Household electricity consumption, appliances and electronics

This is another area where efficiency gains are more than offset by steeply rising demand resulting from behavioural changes.

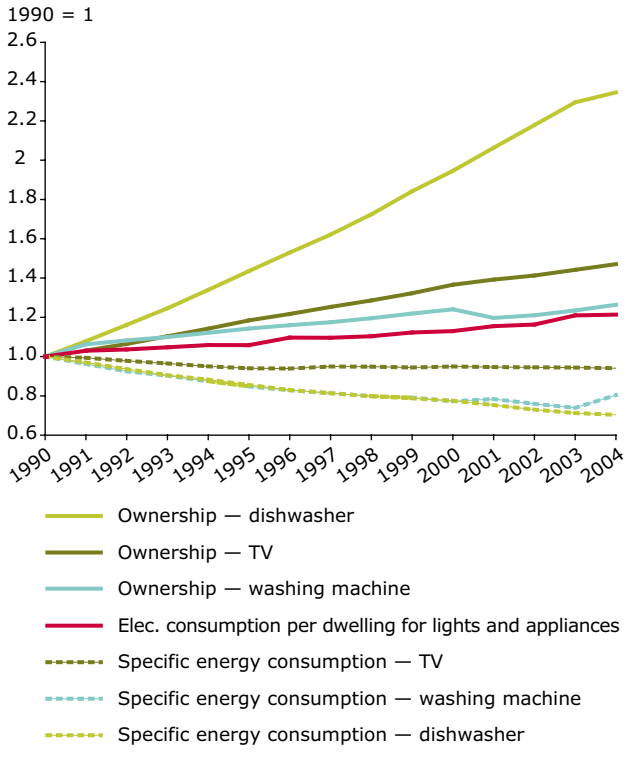
Most impacts of electricity use result from its production rather than consumption. Currently, consumers have limited influence on the sources of the electricity they consume. However, electricity companies in the EU are increasingly marketing electricity from renewable energy sources and, following a 2003 regulation, all companies are now required to provide details of the sources of electricity (i.e. fossil fuel, nuclear, renewables) being delivered to customers.

Consumers can reduce impacts more directly by reducing consumption. Technological progress, stricter product standards and energy labels in the EU have led to the improvement in efficiency of standard household and kitchen appliances (Figure 6.15). Nevertheless, the total electricity consumption per dwelling for lighting and electrical appliances is increasing by 1.5 % per year. The main causes are increased ownership of standard appliances and new electrical devices. Air conditioning units are a particular concern. The increase in the total number of dwellings by 0.8 % per year is an additional driver, giving an overall annual growth in electricity use for appliances of 2.3 %.

Available data from EU-10 and SEE show that growth of appliance ownership is slow in some countries (Bulgaria, Romania and Poland), but rapid in others (Slovakia, Croatia and Former Yugoslav Republic of Macedonia) ([13]). The picture is similarly mixed in EECCA countries. Ownership of more luxury appliances, such as dishwashers and air conditioners, shows the greatest differences between poorer rural and richer urban areas, for example, 10 % and 15 % respectively for these appliances in central Belgrade compared with 2 % for both in rural Serbia.

For many smaller electric and electronic goods, the most critical environmental impacts arise from disposal rather than usage because of their high content of heavy metals and other hazardous substances. This waste category now represents one of the fastest-growing waste fractions in the EU.

Figure 6.15 Trends in energy efficiency, ownership, and overall electricity consumption of selected household appliances, EU-15

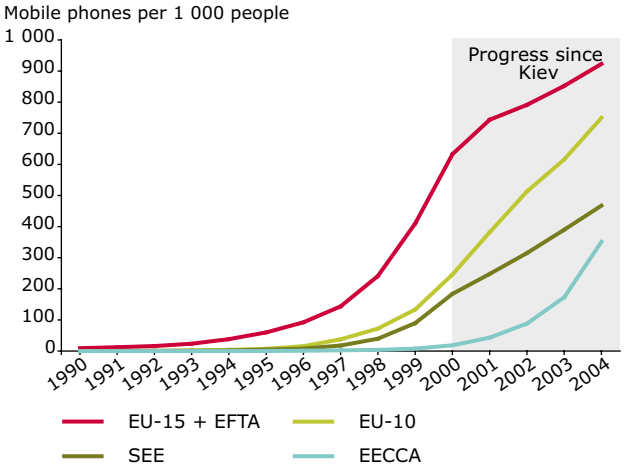


Source: Enerdata, 2006.

The quantity of electric and electronic goods for disposal is dependent both on ownership levels in the population (Figure 6.16) and their replacement rates. Today, replacement is more often driven by changing fashion and small technical advances than by the useful lifespan of an appliance. Mobile phones and computers are examples of such production-driven growth in consumption. Mobile phones in the EU are now being replaced every 25 months with the younger generation disposing of them after only 20 months (Telephia, 2006).

While replacement rates of electronics are lower in SEE and EECCA countries, ownership is rapidly increasing. At the beginning of 2006, there were 120 million mobile phone subscriptions in the Russian Federation amongst a population of 147 million.

Figure 6.16 Mobile phone ownership in four pan-European regions



Source: World Bank, 2007.

Private transport

While private cars offer benefits in rural areas where public transport is sparse, in urban areas the private car is the most polluting and least energy-efficient method of transportation per passenger.

([13]) EU-10, Romania and Bulgaria data obtained from Enerdata, 2005. Other countries' data collected from national statistics offices.

Box 6.8 Electricity drains: stand-by mode on appliances

Electricity used by consumer electronics while on stand-by mode represents 8 % of total United Kingdom household electricity consumption (DTI, 2006). The International Energy Agency (IEA) has estimated that it takes the equivalent of four nuclear power plants to power stand-by mode across Europe. Unless action is taken, this will increase to the equivalent of eight nuclear power plants by 2010 (Woods, 2005). Much of this wasted energy arises from permanently connected power supplies, which are estimated to average 20 per home in WCE.

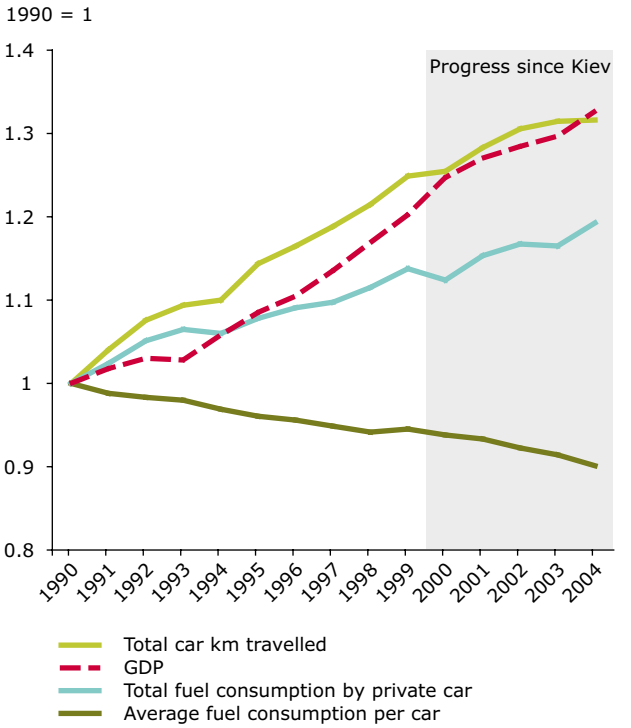
The International Energy Agency began a campaign in 1999 calling on manufacturers to reduce stand-by consumption to 1 Watt by 2010 (OECD/IEA, 2007). This initiative was approved by the G8 leaders at their summit in Gleneagles in July 2005 and is now being put into practice. While Japan and China have taken measures to force manufacturers to meet such targets, the EU is relying on voluntary measures under European Codes of Conduct and the Energy Star agreement. Voluntary commitments by the European Information & Communications Technology Industry Association (EICTA) reduced television and video player stand-by consumption by half, to around 3.5 Watts between 1996 and 2001. However the advent of digital television is presenting new challenges. The code of conduct for digital television has a target for active standby of 7–9 Watts by 2007, far greater than the 1 Watt target ([14]).

More rapid advances could potentially be made through simply encouraging people to turn their appliances off. However, a Belgian study demonstrates consumer reluctance to take even such simple actions. While 81 % of Belgian homeowners are aware of the impact of stand-by mode, only 29 % never use stand-by mode while 37 % always do (Bartiaux, 2006).

Increases in car ownership have been driven by perceptions of greater flexibility and improved mobility. Car ownership has also become a symbol of individualism and personal freedom. A recent Dutch survey showed perceptions of cars among the public to be better than for public transport for all characteristics except safety (Steg, 2006). The negative perception of more sustainable transport can be reversed through integrated town planning and investment in infrastructure, combined with market-based instruments to reduce the attractiveness of cars. This has been demonstrated in model cities such as Strasbourg and Copenhagen where car ownership remains low and use of more sustainable transport forms, such as bicycles or public transport, is high.

Car ownership has increased steadily with incomes. Car ownership in EU-15 and the number of kilometres travelled have increased at the same rate as GDP growth since 1990 (Figure 6.17). Moreover, in many countries (e.g. Austria, Italy, Spain, the United Kingdom and Germany) consumers have shown a strong preference for larger and less fuel-efficient cars, despite unfavourable differential road taxes (Enerdata, 2006). These trends more than

Figure 6.17 Growth in private car travel versus fuel efficiency in EU-15



Source: Enerdata, 2006.

([14]) www.iea.org/Textbase/work/2003/set-top/Bertoldi.pdf.

offset voluntary efforts by manufacturers to improve average fuel efficiency. Overall, fuel consumption by cars has grown by 20 % since 1990, despite their fuel efficiency improving by more than 10 %.

Private car ownership, albeit starting from a much lower base, is increasing even more rapidly beyond EU-15, together with its associated impacts (section on Transport). Private car ownership in EU-10 doubled between 1990 and 2003. Ownership rates in individual countries within EECCA and SEE vary by a factor of five, with the highest rates in Croatia, Bulgaria, the Russian Federation, Belarus and Ukraine, and the lowest rates in Tajikistan, Kyrgyzstan and the Caucasus.

6.3.3 Options for more sustainable consumption

While there has been a relative decoupling of material and energy use from economic growth in WCE (Section 6.2), there is little evidence to show decoupling of the global environmental impacts of European consumption. While current consumption in WCE is unsustainable, future consumption will be even less sustainable unless action is taken. Environmental impacts of consumption can be decoupled from economic growth by:

- reducing the impacts of 'business as usual' consumption through reducing impacts at the production, use and disposal stages of common consumer goods and services; and
- wholesale shifts in consumption patterns transferring demand from goods and services of higher to lower material and energy-use categories.

Such developments require a concerted effort from all actors including public authorities, business and consumers. Public authorities may invest directly in more sustainable infrastructure such as public transport systems, or adjust the framework within which business and consumers operate, to promote sustainability. Such adjustments can be carried out using:

- laws and regulations (e.g. emission controls, product standards, control of substances);
- market-based instruments (e.g. use-based charges, tradeable permits, differential taxes, subsidy removal);
- support for technological innovation; and
- environmental certification standards for businesses (e.g. EMAS, ISO 14001) and standards for the provision of environmental information to consumers (e.g. energy labels, organic food labels).

These measures are interactive and have often been found to work most effectively when used in association with one another (OECD, 2001). In practice, the challenge is to implement the right combination of policy instruments to achieve a specific environmental goal.

The Kiev Declaration identifies market-based instruments in particular as a useful tool for decoupling impacts from economic growth. Use of such instruments increased rapidly in the EU between 1992 and 1999, but since then the share of revenue raised by environmental taxes has decreased (Box 6.9).

The challenge for business is to provide goods and services that are sustainable in both their production and usage whilst remaining profitable. In some cases reducing impacts has economic benefits through improved efficiency, for example, provided the pay-back times are acceptable. Market-based instruments have been used to tip the scales and reduce pay-back times.

The environmental performance of the business can be used as a marketing tool via the ISO 14001 or EMAS environmental management certification for businesses and organisations. The number of companies certified under EMAS rose rapidly between the mid-1990s and 2002 although they still remain a small proportion of the total number of companies. Despite the Kiev Declaration calling for greater corporate environmental and social responsibility, certification of new companies stagnated in the EU after 2002 (European Commission, 2007a). However, ISO 14001 certification has been growing steadily in SEE and the eastern European countries of EECCA (plus Kazakhstan and Azerbaijan) since 2001 where, at the end of 2005 over 1 200 companies

Box 6.9 Market-based instruments and environmental tax reform

Denmark and the Netherlands are the most prolific users of environmental taxes in Europe with environmental tax contributing nearly 10 % of all taxes. In 2003, the average for EU-15 and EU-25 was 7.2 % and 6.6 % respectively, mostly from energy taxes. This was, however, a reduction from 7.6 % and 6.8 % in 1999 (Eurostat, 2007c). Tax on labour meanwhile amounts to 51 % of all tax revenues. There is significant potential for environmental improvements and protection of resources to be gained from shifting tax on labour towards environmental taxes such as taxes on unsustainable goods and services. However, environmental tax reform (ETR) has stagnated in most of WCE.

One potential problem with consumption-based taxes is when they are placed on essential goods for which there are no alternatives, such as utilities. In these cases, the greatest impacts of environmental taxes can be on low-income families. This has inhibited the use of market-based instruments in a number of EECCA countries and SEE, where water and heating in particular are still largely subsidised. The limits beyond which affordability becomes a problem are seen as 10 % for energy and 4 % for water, as a proportion of total household income (EBRD, 2005). When taxes impact on low income families, compensation can be given to those most affected. A number of EECCA countries and new EU Member States have made progress in developing differential tariffs which allow affordability while giving financial incentives to reduce consumption and improve efficiency (UNDP, 2004).

were certified, after less than one hundred in 2001 (UNEP/EEA, 2007).

Consumers can make sustainable consumption decisions based on information provided by government and business. They can choose a more sustainable product or service from a group providing the same function by following eco-labels (Box 6.10), or they can reduce their consumption of impact-intensive items. The latter requires guidance from government, which is generally lacking. Market-based instruments can provide financial incentives to consumers to make these choices.

Businesses and public authorities also act as consumers and can take responsible procurement decisions. There is some evidence that green public procurement (GPP) has become more widespread in a number of EU Member States (Box 6.11). In EECCA and SEE, only Bosnia and Herzegovina, Bulgaria, and Serbia and Montenegro have established a sufficient legal basis for GPP (UNEP/EEA, 2007). Other SEE countries and EECCA

Box 6.10 Labelling and environmental information — the Nordic Swan eco-label

In 1989, the Nordic Council of Ministers (Finland, Iceland, Norway, Sweden and Denmark) introduced a voluntary certification programme known as the Nordic Swan. Only products which satisfy strict environmental requirements can carry the label. The label is intended to provide consumers with guidance in choosing products which are the least hazardous to the environment, and to stimulate manufacturers to develop such products. Criteria for 42 product categories have been established, and licences have been awarded to over 350 companies and over 1 200 products. Product types are concentrated on cleaning fluids and powders, toiletries and paper products. Nordic Swan-labelled washing powder represents 70 % of sales of all washing powder in Norway. In Denmark the share of sales of Nordic Swan products within nine main product categories increased from 2 % in 1998 to 12 % in 2002 (Nielsen, 2005).

The European Flower eco-label has been less successful (EVER Consortium, 2005). Although sales of items increased 500 % between 2003 and 2004, overall penetration is low (European Commission, 2007b). The main barrier to greater market penetration of eco-labelled goods is that a majority of consumers are unwilling to pay extra for improved environmental quality. This could be tackled by a combination of labelling and market-based instruments, such as VAT-reduction for labelled products. This has, however, been rejected in the short term by the European Commission (European Commission, 2003).

Box 6.11 Green Public Procurement (GPP) in the EU

While government consumption expenditure is three to five times lower than household expenditure across the pan-European region, public expenditure presents a potentially more stable market for environmental goods and services. Within EU-25, just under 1 500 local councils have budgetary responsibilities for over 30 % of the population. Purchasing decisions are made by far fewer players and the potential for building up a significant level of sustainable purchasing is higher. Moreover, procurement contracts with a single large council can create and sustain a market for green products or services, which can then spread into the private sector.

Within EU-25, 67 % of municipalities responding to a 2005 survey stated that environmental criteria are included in their tender documents (although a detailed analysis of 1 100 tender documents showed that a much lower percentage included concrete preferences for more sustainable goods and services). Seven northern European countries were identified as being most progressive in the field of Green Public Procurement: Austria, Denmark, Finland, Germany, the Netherlands, Sweden and the United Kingdom. The most important barriers were perceived to be:

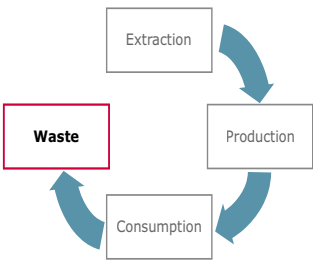
1) the price of more environmentally responsible goods and services;
2) lack of management support and policy;
3) lack of knowledge;
4) lack of practical tools and information; and
5) lack of training.

The EU has published a handbook which aims at reducing barriers related to knowledge, information and training ([15]).

countries could consider giving high priority to enabling GPP in national procurement legislation.

Breaking the link between the growth of consumption and its environmental impacts will be a particular challenge for the rapidly growing economies in EECCA and SEE. Part of the solution may be found in identifying, improving and re-investing in more sustainable infrastructure and behaviour. Potential examples include: widespread district heating systems (albeit currently inefficient and run down), use of market-based instruments, and urban development coordinated with public transport systems.

6.4 Waste



Waste causes a number of impacts on the environment, including pollution of air, surface water, and groundwater. Valuable space is taken up by landfills and poor waste management causes risks to public health. Waste also represents a loss of natural resources. Sound management of waste can therefore protect public health and the quality of the environment whilst supporting conservation of natural resources.

Historically, waste management systems were introduced to protect public health. In the 1970s and 1980s, waste management systems focused on controlling outlets to air, water and groundwater. In recent years, the focus has been increasingly on utilising waste as a resource.

This section explores the generation of waste in the pan-European region and its connection to economic activities. It emphasises the importance of preventing emissions from landfills, for example of methane which causes climate change, and diverting waste away from landfills. Finally, the possibilities to use some waste as a resource are highlighted. In principle, all these challenges — avoiding health risks, reducing emissions to the environment and utilising the resources in waste — should be a pan-European objective. However, currently both the main challenges and the solutions differ regionally.

([15]) http://ec.europa.eu/environment/gpp/guidelines.htm.

6.4.1 Waste generation

General trends in total waste generation

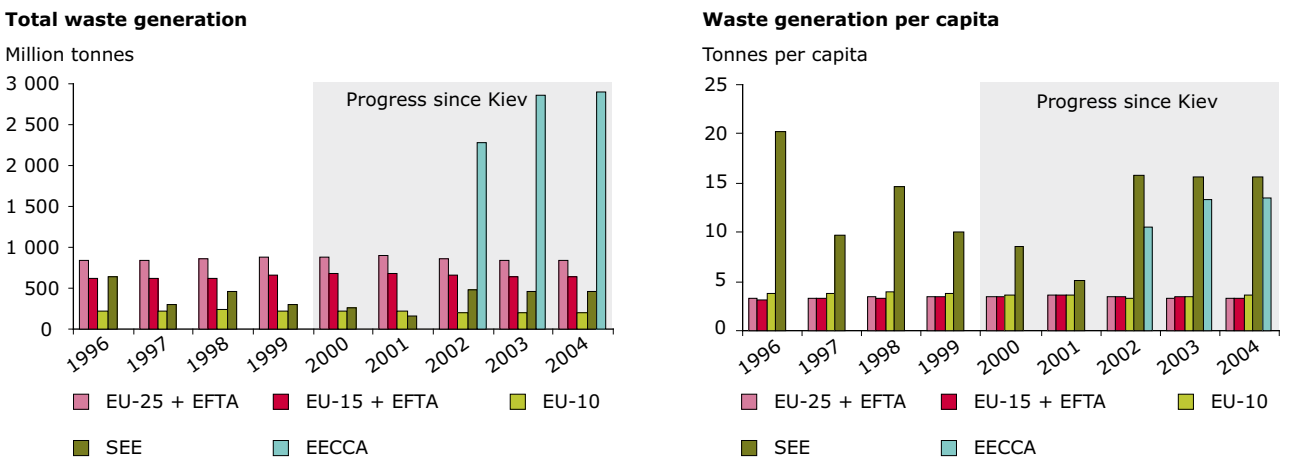
Since the Kiev conference, there has been some improvement in the quality of available data. A new EU waste statistics regulation has come into force, and some of the EECCA and SEE countries have introduced better data collection systems. Nonetheless, waste statistics are not complete and, in many cases, it is necessary to use estimates. Moreover, there are differences in definitions and classifications as well as waste registration procedures. This makes comparison between EU, EECCA and SEE countries difficult. Based on the data available:

- annual waste generation in EU-25 + EFTA is estimated at between 1 750 and 1 900 million tonnes, or 3.8–4.1 tonnes of waste per capita;
- the EECCA countries are estimated to generate about 3 450 million tonnes of waste annually. On average this equals 14 tonnes per capita, but there are strong differences between countries, from about half a tonne per capita in the Republic of Moldova to 18 tonnes per capita in the Russian Federation;
- the SEE countries are estimated to have an average total waste generation ranging from 5 to 20 tonnes per capita per year ([16]).

A rough estimate of the total annual waste generation in the pan-European region is between 6 and 8 billion tonnes. The amount of waste generated is still increasing in absolute terms but trends differ from region to region (see Figure 6.18). In the period from 1996 to 2004 the total waste generation increased by 2 % in EU-25 + EFTA. In EU-15 + EFTA, total waste generation increased by 5 % in the same period. In contrast, total waste generation in EU-10 declined by 6 % in that period. However, there are large differences between individual countries, and significant annual variations within a country, mainly due to changes in waste generated in the mining industry.

In the five EECCA countries for which data are available, total waste generation increased by 27 % in the period from 2002 to 2004. Per capita waste generation in EECCA is higher than in the EU because of the raw material extraction and processing industries, which generate large amounts of waste (see Section 6.2.3). For example, in the Russian Federation waste generation varies from

Figure 6.18 Total waste generation and waste generation per capita



Notes: EU-15 + EFTA includes figures from Belgium, Denmark, Germany, Iceland, Italy, the Netherlands, Norway, Portugal and Switzerland. EU-10 includes figures from the Czech Republic, Estonia, Malta, Poland, Slovakia and Slovenia. EECCA includes figures from Azerbaijan, Belarus, the Republic of Moldova, the Russian Federation and Ukraine. SEE includes figures from Bulgaria and Romania.

Sources: Eurostat, 2007d; UN, 2006; SOE the Russian Federation, 2004.

([16]) This figure was calculated based on information from Bulgaria and Romania, which account for about 25 % of the population.

Box 6.12 Waste management and employment

The waste management sector can create significant economic activity and jobs. For example, in 2004, the waste sector in the Russian Federation was estimated to employ some 500 000 people in a market worth more than 28 billion roubles a year (about USD 1 billion), of which 70 % to 75 % was spent on waste collection and transportation services (Abramov, 2004). In Turkey, the government estimates that about 75 000 people earn a living from the informal, kerb-side collection and separation of waste for recycling.

5 to 7 tonnes per tonne of actual product, and in some cases may be even higher (WasteTech, 2005).

Furthermore, despite the political importance of waste prevention, the amount of waste generated is growing due to the increase in economic activity. Economic growth has proven a much stronger driver for waste generation than different prevention initiatives, including recommendations for the development of waste prevention programmes in the Kiev Strategy.

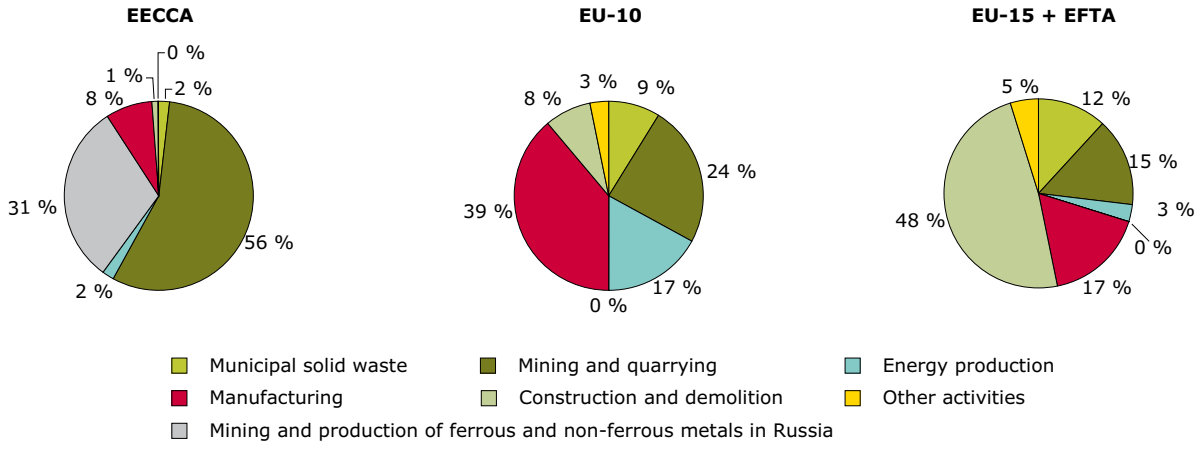
Waste generation by sector and type

Waste generation rates vary strongly between sectors and waste type, reflecting the different socio-economic drivers and, in some cases, different waste definitions. Many EECCA and some EU-10 countries produce large amounts of mining waste (see Figure 6.19). In EECCA, between half and three quarters of total waste generated comes from mining, quarrying and production of metals. Countries with a high level of household consumption such as the EU-15 + EFTA have high rates of municipal waste generation. However, the single largest waste stream in the EU-15 + EFTA is from construction and demolition, generated largely by intensive construction activities following the unification of Germany.

The generation of municipal waste is growing in the pan-European region except for some countries in EU-10 and SEE (see Figure 6.20). This increase is related to the increase in household consumption (for example furniture and equipment) and higher replacement rates for many products. However, improved registration and collection of municipal waste could also be a part of the explanation for the increase.

The growth is expected to continue, especially in EECCA, where the average annual increase in collected municipal waste in the Russian Federation and Ukraine is a consistent 8–10 % (Abramov, 2004; Ukraine, 2006). The slight decrease in EU-10 might partly be due to a higher re-use

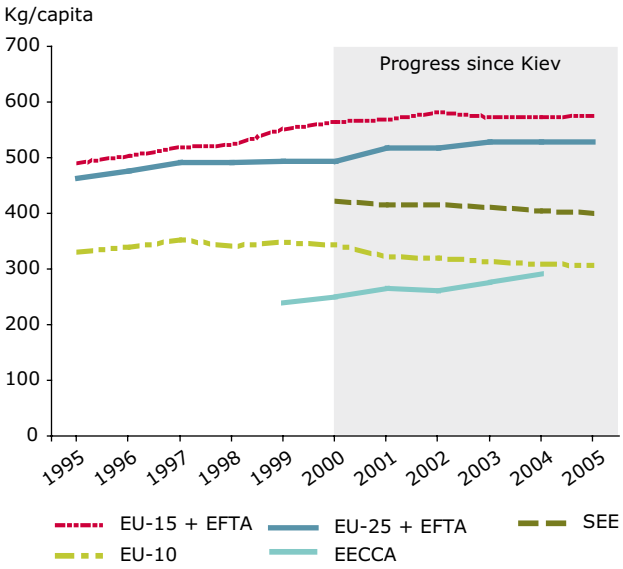
Figure 6.19 Total waste generation by sector, 2004



Notes: The EECCA graph includes figures from Belarus, the Republic of Moldova, the Russian Federation and Ukraine. Ferrous and non-ferrous metals in the Russian Federation are indicated separately, because it was not possible to obtain data dividing the amount between 'mining and quarrying' and 'manufacturing'.

Sources: Eurostat, 2007d; UN, 2006; SOE the Russian Federation, 2004.

Figure 6.20 Municipal waste collected



Notes: EECCA includes figures from Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan, the Republic of Moldova, the Russian Federation and Ukraine. SEE includes figures from Albania, Bulgaria, Croatia, Romania and Turkey.

Sources: Eurostat, 2007d; UN, 2006; SOE the Russian Federation, 2004; Ukraine, 2006.

of organic food waste as animal feed, and partly because of the use of combustible waste as a fuel in individual households as a result of increasing coal prices. Furthermore, the gradual introduction of weigh bridges at the landfills has provided more reliable information. Previously, the amounts of municipal waste were estimated according to the volume, which may have led to an overestimation of the mass.

Hazardous waste generation

More than 250 million tonnes of hazardous waste, 3–4 % of the total waste, are generated annually in the pan-European region, mostly in EECCA, where the Russian Federation dominated hazardous waste generation (Figure 6.21). The large differences in generation of hazardous waste between EECCA and other regions are due to the varying classifications of hazardous waste. In EECCA, more waste types are classified as hazardous, and therefore the figures on hazardous waste are not completely comparable.

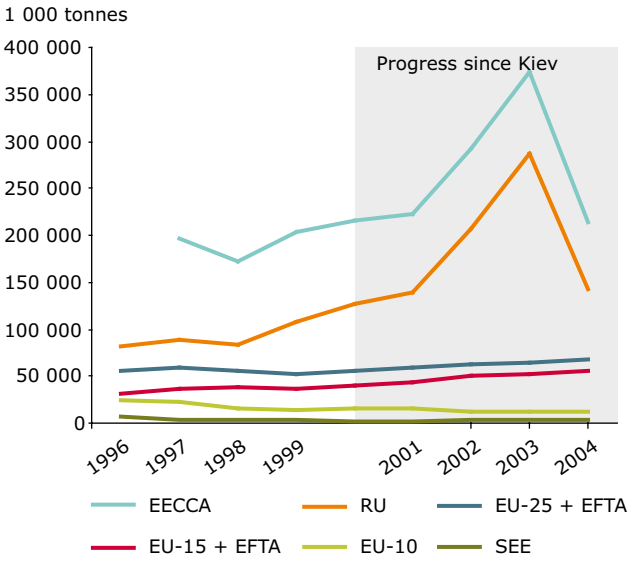
Hazardous waste generation in EU-25 + EFTA increased 20 % over the period 1996–2004. The increase in EECCA until 2003 resulted from increasing economic activity since the mid-1990s, although improved registration probably also played a role. The available information does not explain the decline from 2003 to 2004.

Accumulated waste — legacy of the past

Many EECCA countries are experiencing environmental problems arising from the long-term storage of hazardous waste generated during the Soviet era. A variety of pollutants accumulated, including radioactive, military and industrial wastes. The break-up of the Soviet Union, the formation of new independent EECCA countries and the changes of ownership mean that much of this waste has no legal owner. To make matters more complicated, the smaller EECCA countries often have little capacity to improve the situation.

In Central Asia, large amounts of industrial waste have been accumulated, mainly from resource mining and processing activities. The estimated amounts include 40 billion tonnes in Kazakhstan, 1 billion tonnes in Kyrgyzstan, 210 million tonnes in Tajikistan,

Figure 6.21 Hazardous waste generation



Notes: EECCA includes Armenia, Kyrgyzstan, Kazakhstan, the Russian Federation and Ukraine. SEE includes Bulgaria, Croatia and Romania.

Sources: Compiled by EEA-ETC/RWM based on data from Eurostat, 2007e; EEA-ETC/RWM, 2006b; European Commission, 2006; Basel Convention, 2006; UN, 2006; SOE the Russian Federation, 2004 and extrapolated.

Box 6.13 Obsolete pesticides in the Republic of Moldova — a case for waste inventories

Before the 1990s, agricultural Moldova served as a test bed for the use of pesticides. About 22 000 tonnes of persistent organochlorinated pesticides were brought into the country, and 15–20 kg of active substances were applied per hectare each year. As more pesticides than needed were imported, large stockpiles of unused and prohibited pesticides built up. The use of pesticides has now decreased to around 1 kg per hectare (2002), but the environmental problems caused by stockpiles including persistent organic pollutants (POPs) have remained.

Photo: Obsolete pesticides in the Republic of Moldova © GEF/WB 'POPs Stockpiles Management and Destruction Project'; Ministry of Ecology and Natural Resources, the Republic of Moldova

After independence, the stockpiles were initially guarded in storehouses, but during land privatisation, state control was discontinued in many cases. By 2003, about 60 % of the storehouses were destroyed and only 20 % remained in a satisfactory condition. Some of the obsolete pesticides were stolen and used; others remained unguarded in deteriorated packaging without labels. Currently, the total amount of obsolete pesticides in the Republic of Moldova is approximately 5 650 tonnes, including about 3 940 tonnes buried at the pesticide dump in Cismichioi and 1 712 tonnes stored in 344 poorly equipped or inadequate facilities. Soil contamination with chloro-organic pesticides is high around many stockpiles, exceeding maximum permissible concentrations by up to nine times.

Several projects have now been launched to strengthen the regulatory and institutional arrangements for long-term control of POPs in line with the Stockholm convention, including re-packaging, safe temporary storage in a centralised facility, and final disposal of pesticide waste. The value of the projects is USD 12.6 million, jointly financed by the Government of the Republic of Moldova and international donors.

The Republic of Moldova's case underlines the need for the efficient registration of hazardous substances, and the maintenance of accurate statistics, which is often a prerequisite for initiating action. The Republic of Moldova signed the Stockholm Convention dealing with POPs and submitted a national implementation plan in August 2005. Armenia was the second EECCA country to submit an implementation plan in April 2006. POPs-related projects have also been launched in Belarus, Georgia and the Russian Federation.

Source: Ministry of Environment, Republic of Moldova, 2007.

165 million tonnes in Turkmenistan and 1.3 billion tonnes in Uzbekistan. The wastes contain radioactive nuclides and metal compounds (e.g. cadmium, lead, zinc and sulphates) (UNEP, 2006).

There are also large stockpiles of obsolete pesticides containing persistent organic pollutants (POPs), which date back to the Soviet era and that have become a large risk to the environment (see Section 2.5, Hazardous chemicals). Supply of pesticides to state-owned collective farms was administered centrally, and substantial amounts were sent to farms each year regardless of need. Stockpiles grew gradually, with farmers storing them as best they could. Following the break-up of the Soviet Union the supply of pesticides stopped, but these stockpiles have increasingly become a problem, as many storage facilities have no legal owner. In Uzbekistan about 18 000 tonnes of banned and obsolete pesticides have been kept in underground depositories since 1972, while in other areas pesticides and their packaging materials were buried in landfills.

6.4.2 Waste management

The general principles of waste management are embodied in the so-called 'waste management hierarchy'. The top priorities are to prevent the

generation of waste and to reduce its harmfulness. Where this is not possible, waste materials should be reused, recycled or used as a source of energy (incineration). As a final resort, waste should be disposed of safely, which in most pan-European regions means landfilling.

In the EU and EFTA Member States, systems to manage waste are already in place, minimising the risks to public health and reducing emissions to the environment from disposal and recovery facilities. In the EU, there has been a policy shift over the last 10–15 years away from end-of-pipe control of waste-related emissions, and administrative demands for registration, permits and waste management planning. The present approach focuses on treating waste as a resource and using waste prevention and recovery as a way of saving resources and minimising impacts on the environment. Current EU policies include requirements for waste prevention, re-use, recycling and recovery, and restrictions on waste to landfill.

In EECCA and SEE, much more attention is still placed on developing waste strategies and the implementation of basic waste legislation. Even though many of those countries draw on EU policies and directives for their own legislation, they are not under legal obligation to ensure better waste management. The main challenge in countries where the capacity of local authorities to deal with waste is often limited, is ensuring the proper collection of waste and disposing of the waste in legal and safe landfills. In addition, the utilisation of resources contained in waste in EECCA and SEE is not driven so much by legislation as by economic forces.

Waste prevention

Waste prevention is a top priority in the waste hierarchy, but so far, achievements in this field have been less than satisfactory. There is a large gap between the political goals on waste prevention expressed in various EU directives and in the Kiev strategy, and the continued growth in waste generation. Waste amounts are rising and projections expect this trend to continue in the future, along with the increasing environmental impacts from waste.

Usually, increasing economic activity means more waste generation. Since economic growth is the predominant policy goal across Europe, it is often difficult to find politically acceptable instruments which can successfully limit waste generation. Nonetheless, experience shows that successful prevention does require the use of a variety of instruments.

The objectives of waste prevention are: 1) reduction of emissions; 2) reduction of hazardous substances in material streams and of their dissipation; and 3) improvement of resource efficiency. Consequently, the priority waste streams to be addressed for waste prevention are those with big mass flows, hazardous wastes, and wastes containing scarce substances.

Actions at the enterprise level can address the extraction of raw materials, the processing of raw materials and the appropriate design and manufacturing of products. Cleaner technology programmes have proved useful instruments in reducing waste generation in industry. For example, the EU voluntary instrument EMAS (eco-management and audit scheme) rewards those industries that improve their performance on a continuous basis, providing an incentive to improve long-term performance. Life-cycle approach in product design, extending useful life or facilitating waste disposal is another example of an important prevention instrument. An example of successful prevention is the phasing out or reduction of certain heavy metals in batteries, such as mercury and cadmium, whereby improved recyclability and limited dissipation of hazardous substances to the environment are achieved. Economic instruments, such as national taxes on waste generation, can further stimulate industries to limit their wastes.

Achieving a reduction in waste generated by households is a much more complicated task since it implies lowering consumption in general and making changes in consumption patterns. This, in turn, requires alterations in people's habits and lifestyles. Some options for more sustainable consumption are described in Section 6.3.

Many successful environmental improvements in industry have occurred when government

has played a consistent role by setting goals and timelines for improvements. Examples of successful government actions include: funding or in other ways supporting innovative changes, setting taxes providing significant changes in cost structures or intervening with traditional legal requirements. In those cases where declared government policies have not been followed by other supportive measures, or even just the threat of future intervention in the case of non-compliance, not much has been achieved.

In some cases, policy choices that do not seem to have any connection with waste management can, nonetheless, have significant effects. Organic food production, for example, has a very high potential for waste prevention, both quantitatively and in terms of toxicity. The elimination of synthetic pesticides and fertilisers reduces toxicity as well as the energy consumption associated with their production, and thereby the wastes produced in the extraction of fuels and their combustion. Another example comes from improved public transport, which could have a positive impact on energy consumption and on the number of end-of-life vehicles and vehicle parts, one of the fastest growing waste streams in Europe.

Landfill

Landfill — the least preferable environmental option in the waste management hierarchy — is still the most common waste management method used across the pan-European region. In the EU, 31 % of total waste generated is landfilled, 42 % is recycled, 6 % is incinerated with energy recovery and 21 % is unspecified (data from 19 Member States). Consistent information on waste disposal methods in EECCA and SEE is also not available. However, in the Russian Federation, between 40 % and 57 % of total waste generated from industry was landfilled in the period 2002–2004 (SOE the Russian Federation, 2004).

For municipal waste, landfill is also the dominant disposal method. However, the percentage of municipal waste in landfill declined in EU-25 + EFTA from 63 % in 1995 to 42 % in 2005 (Table 6.1) during a period when generation of municipal waste increased. Nevertheless, similar absolute amounts of municipal waste are landfilled in the pan-European region today as ten years ago.

Diverting waste from landfills

Since the beginning of the 1990s, many EU directives and national policies have been developed which set targets for recycling and recovery, as well as putting limits on the amount of waste that can be sent to landfill. These are now beginning to produce results.

The percentage of municipal waste recycled (including composting) has increased significantly (Figure 6.22). In EU-15 + EFTA, the percentage of recycling has almost doubled, reaching 40 % in 2004. In EU-10, however, recycling and incineration are minimal.

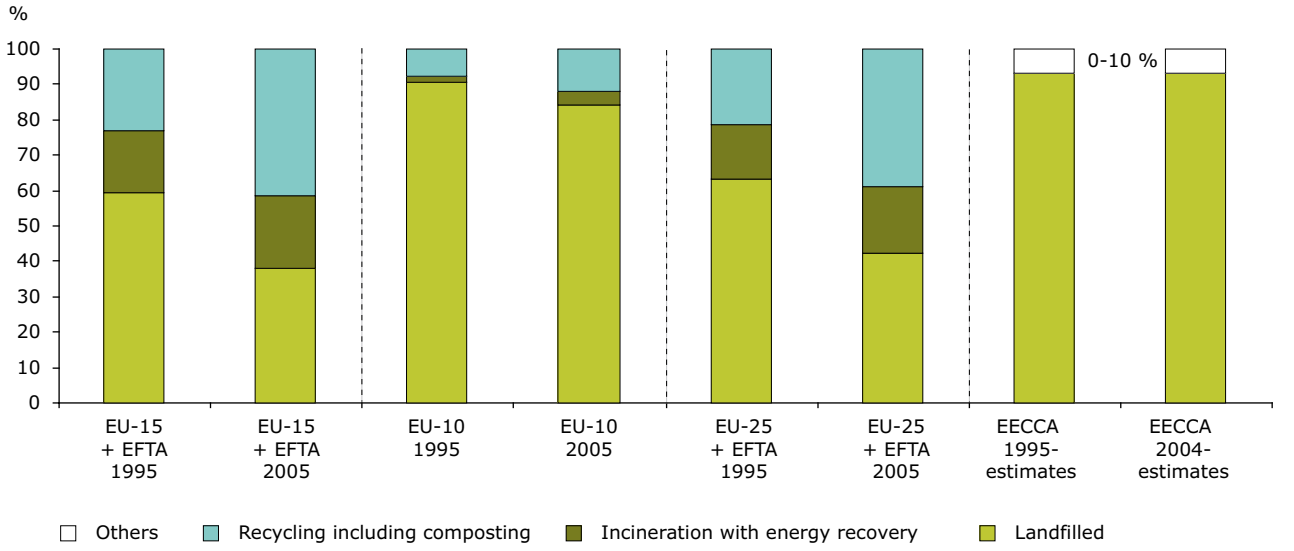
Table 6.1 Municipal waste generated and sent to landfill

Region	1995 or 1996			2004 or 2005		
	Generation (1 000 tonnes)	Landfill (1 000 tonnes)	% of landfill	Generation (1 000 tonnes)	Landfill (1 000 tonnes)	% of landfill
EU-15+EFTA	187 706	111 535	59	228 372	86 691	38
EU-10	24 871	22 482	90	22 740	19 098	84
EU-25 + EFTA	212 578	134 018	63	251 112	105 789	42
EECCA (rough estimates, June 2006)	50 000	45 000–50 000	90–100	66 000	60 000–66 000	90–100
SEE (BG, HR, RO, TR)	42 345	30 200	71	42 841	36 291	85

Notes: The EECCA countries include figures only from Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan, the Republic of Moldova, the Russian Federation and Ukraine. First set of figures is based on data available for either year 1995 or 1996, whichever more recent, and second set of figures covers either year 2004 or 2005.

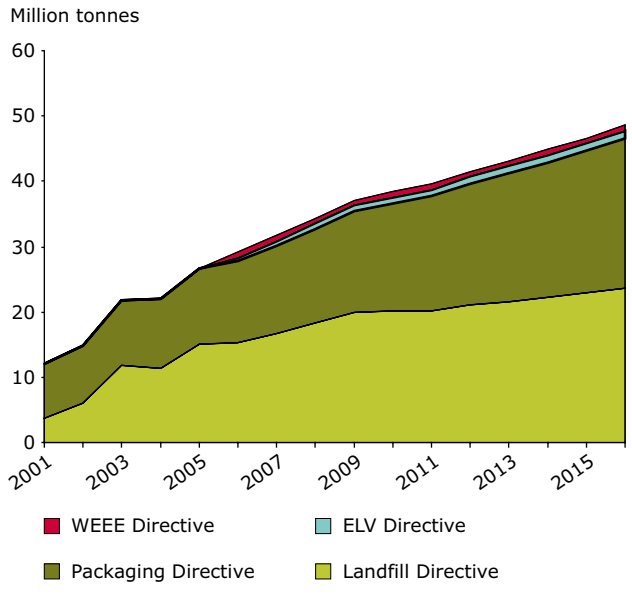
Sources: Eurostat, 2007b; UN, 2006; EEA-ETC/RWM's own calculation 2006.

Figure 6.22 Treatment of municipal waste



Sources: Eurostat, 2007b; EEA-ETC/RWM's own calculation based on Eurostat's figures.

Figure 6.23 Projection of waste diverted away from landfill, EU-25



Source: EEA-ETC/RWM, 2006c.

Full compliance with EU legislation and implementation of national waste strategies are expected to lead to a further reduction in the amount of waste sent to landfill, with an estimated 25 million tonnes of waste expected to be diverted away from landfill to recovery between 2005 and 2016.

Figure 6.23 illustrates the forecast effects of four selected EU waste-related directives (Waste Electric and Electronic Equipment, End-of-life Vehicles, Packaging and Landfill Directives).

Municipal waste management

With the economic growth in EECCA and SEE, it is likely that their municipal waste generation will become similar to that in EU, both in volume and composition. Given this, and the fact that currently almost all municipal waste in EECCA and SEE goes to landfill, it is important that landfills maintain reasonable technical standards, including the collection of leachate and the safe disposal of generated methane. However, illegal dumping and inadequate disposal sites still remain a public health problem — in the Russian Federation, only 8 % of landfills are estimated to be safe (Abramov, 2004). In Turkey, where Istanbul is the only big city with a proper waste collection and management system, it is estimated that about 70 % of all municipal waste is dumped in uncontrolled or illegal sites since in the whole country there are only 16 sanitary landfills, four composting plants and one incinerator complying with the legislation.

Little progress has been made since the Kiev conference on the efficient collection of municipal waste and its safe disposal in EECCA and SEE.

Box 6.14 Waste and climate change

Reducing the volume of biodegradeable waste buried in landfills lowers the amount of methane gas generated in them. Methane gas (CH_4) is a greenhouse gas with up to 20 times the warming power of carbon dioxide (CO_2). Figure 6.24 illustrates the situation in the EU-25 since 1980, and projects developments forward to 2020. Assuming that all countries comply with the Landfill Directive, even if the total amount of municipal waste increases, by 2020 the expected emissions of CH_4, in CO_2-equivalents, will be 10 million tonnes lower than in 2000.

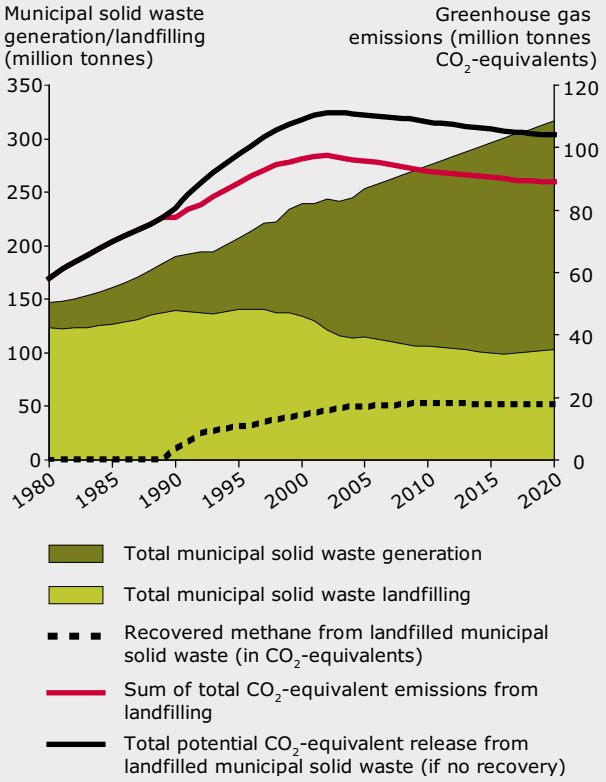
Methane, rather than escaping to the atmosphere, can be recovered and used as a clean burning fuel for the generation of electricity. This has advantages not only in energy terms, but also in economic terms particularly by way of Joint Implementation (JI) and the Clean Development Mechanism (CDM) of the Kyoto Protocol (see Chapter 3, Climate Change). Under the current price regime for carbon credits, with a value of at least EUR 5 per tonne of CO_2-equivalent in 2006, control and use of methane could finance a substantial part of the investment costs in collection systems and treatments plants.

The Clean Development Mechanism in action

Kyrgyzstan has recently approved the first CDM projects under a cooperative agreement with Denmark. The methane gas generated in its capital Bishkek's landfill will be collected and utilised as a fuel for the generation of electricity. In the period 2006–2012 the estimated reduction in CO_2-equivalents will be more than 500 000 tonnes, and the income from selling this reduction to Denmark will be at least EUR 3.3 million. Benefits may further increase up to EUR 5.2 million, depending on the income from the sale of energy generated by the collected methane. These revenues will fully cover the project costs and create a net benefit of EUR 1.1–2.5 million.

In Armenia, which has made similar agreements with both Denmark and Japan, the Nubarashen Landfill Gas Capture and Power Generation Project in Yerevan is the first approved by the Armenian and Japanese Governments (in 2005). It will save emissions of 2.2 million tonnes of CO_2-equivalents, and generate 200 GWh of new, clean energy over the project's lifetime of 16 years.

Figure 6.24 Generation of municipal waste and CO_2-equivalent emissions from landfills, EU-25



Source: EEA-ETC/RWM, 2007.

Sources: DEPA, 2006 and Nubarashen Landfill Gas Capture and Power Generation Project in Yerevan, 2005.

In general, there is little separation at source of the different kinds of municipal waste, although in some cases specific fractions are separated, and there are even examples of successful implementation (see Box 6.15). Even though most have general waste strategies, only a few have yet developed legislation and action plans for municipal waste, in some cases because of a lack of funding.

Management of hazardous waste

Since the cost of hazardous waste disposal in the EECCA countries is much lower than in WCE, there is an economic incentive to export hazardous wastes to EECCA countries. Since such activities are illegal they are difficult to document, but the risk should not be underestimated. This is demonstrated by, for example, the cases of illegal exports of toxic chemical wastes to Ukraine and

Box 6.15 Improving municipal waste collection in Tashkent

In Tashkent, the capital of Uzbekistan, the two million residents produced more than 3 000 tonnes of solid waste per day in the late 1990s. Amounts of waste were increasing and the system of waste collection, removal and disposal was at risk of collapse. Waste collection vehicles required upgrading, and there was a need for fencing off the collection points and for the acquisition of new bins.

As a result of a USD 56.3 million World Bank project, Tashkent is now among the cleanest cities in the region. Over 13 000 waste collection containers and three types of collection vehicle have been purchased. Excavators and waste compactors operate in the landfill. Two of four planned transfer stations are now in operation, each with an annual capacity of 200 000 tonnes of waste. The emergence of about 400 serviced and some 700 unserviced collection points has stimulated the development of a market for recycled materials. Individuals can now lease a collection point from the municipality to sort out waste and sell recyclables such as paper, bottles and plastic bags. About 1 000 new jobs have been created as a result.

Source: World Bank, 2006.

the Transdniestria region of Moldova (Environment People Law, 2006; Novaya Gazeta, 2004; Kiev Weekly, 2006).

Other than Tajikistan, all EECCA and SEE countries are party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, and, by the end of 2005, had implemented most of the principles of the Convention in their national legislation and strategies, albeit relying greatly on international support. However, only a few countries have the technical facilities for the safe disposal of hazardous waste and therefore, in most cases, these must be either landfilled or stored within the country itself, or exported for proper treatment.

The development of hazardous waste strategies and legislation in EECCA and SEE has mainly taken place in those areas where countries have international obligations or responsibilities, such as under the Basel and Stockholm Conventions. Countries also try to follow the recommendations in the Kiev strategy for EECCA. However, the implementation of legislation on hazardous waste relies to a great extent on international funding.

Sometimes, however, improvement of the situation does not require large investments since smaller investments with proper waste management can provide real benefits. Box 6.16 describes a solution which tackles two problems at once — helping to protect the ozone layer and removing hazardous substances from discarded appliances. It enables recycling or safe destruction of chlorofluorocarbons (CFCs) as well as the safe scrapping of cleaned appliances, allowing the recovery of valuable metals.

Box 6.16 Refrigeration Management Plan (RMP) in the Former Yugoslav Republic of Macedonia

The aim of the RMP project is to develop a comprehensive programme for the recovery and recycling of ozone-depleting substances used in servicing refrigeration equipment, and to prevent unnecessary emissions of these refrigerants into the atmosphere. The project also includes a training programme on good practices in refrigeration maintenance for service technicians and the training of customs officers.

Three recycling centres have been established and 109 service stations provided with recovery and recycling equipment for CFCs/HCFCs. Once the technicians have been trained and provided with recovery and recycling equipment, they are obliged to report on quantities of CFC/HCFCs recovered and recycled. The first successful project, which ran to the end of 2005 and is now complete, recovered 20.8 tonnes of CFCs of which 19.6 tonnes were recycled. A second project is now in place, running until 2010.

Source: Ministry of Environment and Physical Planning, FYR of Macedonia, Ozone Unit, 2006.

Waste management planning

Waste management planning is an important tool for implementing waste policies and regulations. Planning can emphasise incentives for diverting waste away from landfill and using the resources in waste. A recent policy study for EU-25 (EEA-ETC/RWM, 2006d) concludes that the following elements are among the most important in waste management planning:

- involving stakeholders and the general public in the procedure of waste management planning;
- setting targets for economic sectors, specific waste streams and waste treatment;

- improving statistics on waste generation, shipment and treatment for relevant economic sectors and waste streams;
- planning and allocation of responsibility for sufficient treatment capacity;
- including definitions of responsibilities, and descriptions of the ways and means of implementation in the plan.

Waste management planning is compulsory in the EU (under the Waste Framework Directive) and has been used to good effect — in many EU-25 countries, national taxes on waste and waste disposal have been introduced to support waste management, making it more attractive to use the resources in the waste than to dispose of them.

Box 6.17 Waste management planning in Estonia for modernisation of landfills

Before 1991, Estonia had more than 300 municipal waste landfills. The first Estonian National Environmental Strategy required owners and/or operators of every existing landfill for municipal waste to be identified by the year 2000, landfills without operators to be closed, and the number of municipal landfill sites to be reduced to 150 by the year 2010. Already in 2000 only 148 landfills for municipal and other non-hazardous waste were in operation.

The situation changed further as a result of the transposition of the EU Landfill Directive to Estonian legislation in 2000. During the period 2000–2005, special attention was paid to the construction of new modern landfills and the closure and reconditioning of old ones. In the beginning of 2004 only 37 municipal landfills were in use. According to the 2002 National Waste Management Plan, just 8–9 regional landfills of non-hazardous waste are expected to operate in Estonia in the future.

Source: EEA-ETC/RWM, 2006e.

The experience of EU-25 may be useful in helping the EECCA and the SEE countries improve their planning processes. For example, sharing experience in compiling better data on waste could be of benefit, particularly to such countries as Belarus, Croatia, the Russian Federation and Ukraine, which have now started to improve their data collection systems including those concerned with municipal waste. Or the challenges which Estonia, formerly part of the Soviet Union, has overcome in waste management, including the modernisation of landfills, may be typical of those facing many of the EECCA and SEE countries (see Box 6.17).

6.4.3 Waste as an economic resource — recovery, recycling and trade

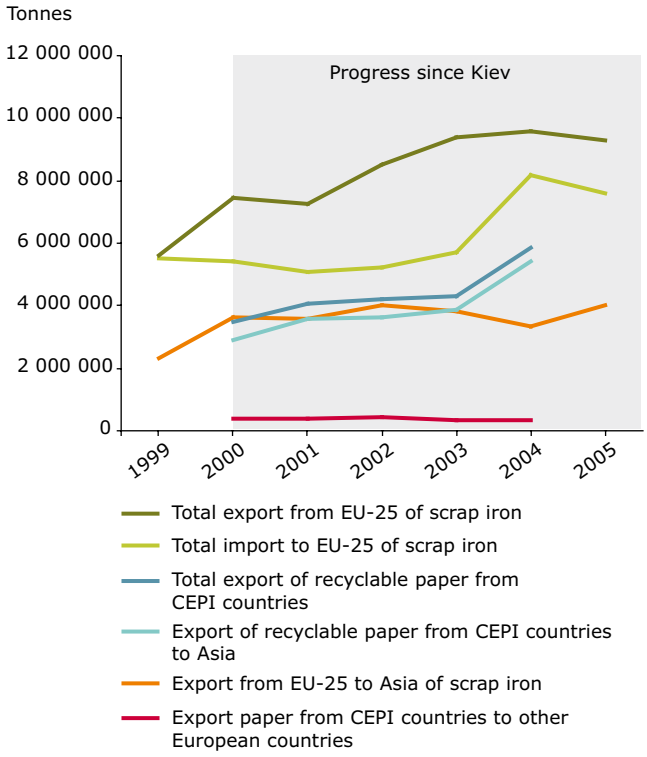
Waste is increasingly seen not only as an environmental problem, but as a potential economic resource whose recovery can bring significant economic benefits. This paradigm change is partly driven by legislation and partly by market forces, and is well illustrated by packaging waste.

Waste as a resource in EU-25 and EFTA

The 1994 EU Directive on Packaging and Packaging Waste introduced specific targets concerning recycling and recovery of this type of waste. In the period 1997–2004 the amount of packaging waste in EU-15 increased by 10 million tonnes. At the same time, the amount of packaging waste sent for recycling increased by 12 million tonnes, growing from 45 % to 56 % of the total. Disposal of packaging waste declined by 6 million tonnes, a drop from 55 % to 32 % of total packaging waste.

But it is not only regulation that stimulates the better use or recovery of the resources in waste. Increasing demand from the Asian market caused increases in world market price of waste paper, cardboard, plastic and scrap metal. The prices of lower grades of recovered paper have increased for 'mixed paper' from up to GBP 4.3 per tonne in 1998 to GBP 20–30 per tonne in 2005 (constant prices, 2005). This had a stimulating effect on recycling with exports of waste paper and cardboard to Asia (especially to China) almost doubling between 2000 and 2004. European exports of 6 million tonnes make up about 10 % of the total amount collected in Europe for recycling. Interestingly, the current net export of 5.5 million tonnes of waste paper should be compared to a deficit of one million tonnes in 1990. In a similar development, exports of scrap metals to Asia increased steeply over the last few years (Figure 6.25).

Figure 6.25 Export of recyclable paper and cardboard and scrap metals from Europe



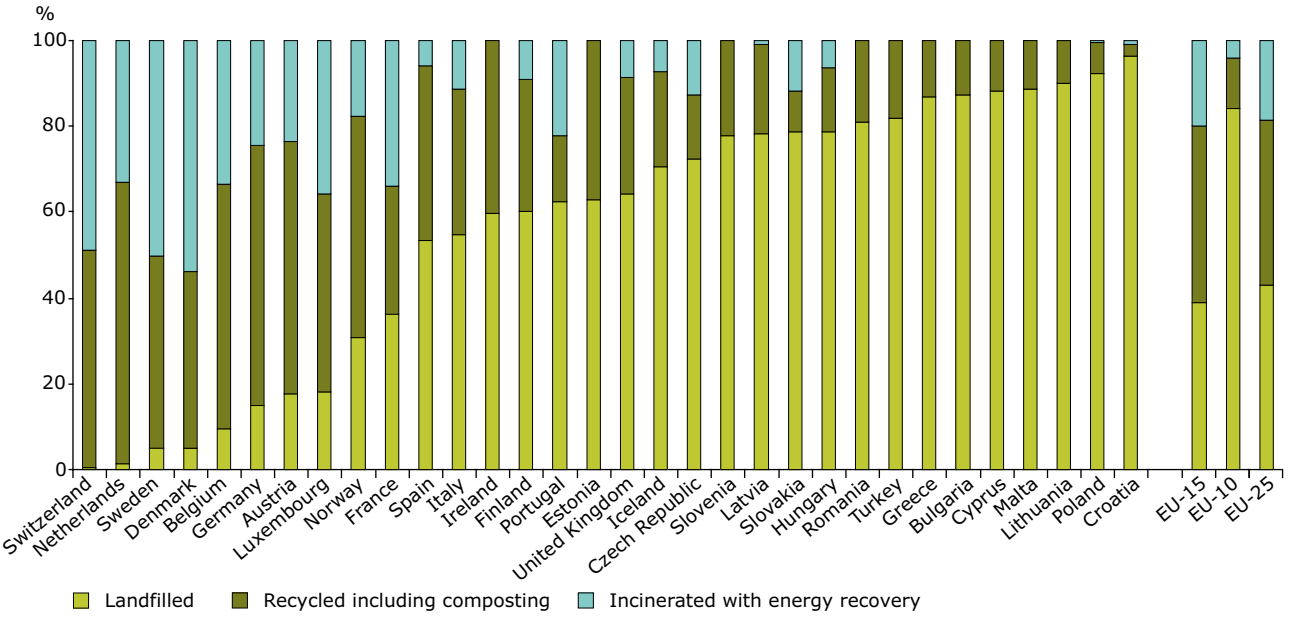
Notes: Members of Confederation of European Paper Industries (CEPI): Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, the Netherlands, the United Kingdom.

Sources: CEPI, 2004; IISI, 2006.

Recycling of municipal waste and incineration with energy recovery are used as complementary tools to divert waste away from landfills and to recover some economic value from waste. However, it should be recognised that strict technical standards of incineration must be observed to avoid detrimental effects on public health and the environment.

When comparing waste disposal options, it is sometimes argued that incineration of waste with energy recovery hinders the development of recycling. However, there is no evidence to support this. Figure 6.26 on municipal waste shows that those countries with the lowest level of landfilling of municipal waste (less than 25 %) also have the highest levels of both recycling and incineration with energy recovery. In contrast, countries with a medium level of landfill (25–50 %) have a medium rate of recycling and limited incineration with energy recovery. Lastly, countries with a high share of landfill (greater than 50 %) have neither much recycling nor incineration with energy recovery.

Figure 6.26 The rate of recycling versus incineration with energy recovery of municipal waste, 2005



Source: EEA-ETC/RWM calculation based on data from Eurostat, 2007d.

Waste as a resource in the EECCA and SEE countries

In general, the level of recycling in EECCA and SEE is low (Box 6.18), and although the potential of recycling municipal waste is large in the EECCA and SEE countries, little decisive progress has been seen in the recent past, largely because of the low collection rates of separated waste.

Indeed, what recycling does take place is not the result of environmental regulations, but is driven by economic forces — recycling in EECCA and SEE tends to focus on industrial waste rather than municipal waste (See Box 6.19).

In some areas, EECCA and SEE are beginning to show similar consumption patterns to the highly industrialised countries. This is already the case for the use of mobile phones, and similar trends are expected for other electronic equipment including computers (see Section 6.3.2). Thus, EECCA and SEE are facing the same challenges regarding proper treatment of these 'new' waste streams (Box 6.20).

Box 6.18 Recycling in the Russian Federation

According to the Ministry of Natural Resources of the Russian Federation, over 30 % of all waste is reused or recycled. Between 40 and 60 % of industrial waste is recycled or reused, but only 3 to 4 % of municipal waste. In 2004, scrap metal collection reached 28.8 million tonnes, a 30 % increase on 2003.

The potential gains from better sorting of municipal waste are very high. The annual losses of useful resources in municipal wastes in the Russian Federation are estimated at 9 million tonnes of waste paper, 1.5 million tones of scrap ferrous and non-ferrous metals, 2 million tonnes of polymers, 10 million tonnes of food and 0.5 million tonnes of glass.

It is estimated that the current collection and recycling of useful materials in waste generates an economic activity of 2–2.5 billion roubles (about USD 70–80 million), but this is only 7–8 % of its potential maximum level.

Sources: SOE the Russian Federation, 2004; Press Service of the RF Ministry of Natural Resources, 29 May 2003; Waste Tech, 2005; Abramov, 2004.

Box 6.19 Increase in collection and recycling of ferrous and non-ferrous metals in Bosnia and Herzegovina

The current rate of recycling in Bosnia and Herzegovina is low compared with the EU Member States, except for the recycling of scrap ferrous and non-ferrous metals, the collection and recycling of which has recently experienced a sudden increase, due to the rise in prices of recyclables in regional and world markets. The privatisation of the local steel mill has paved the way for an additional boost in the ferrous metals collection and processing industry sector. Currently, the estimated recycling rate in Bosnia and Herzegovina is 50–70 % for iron, whereas for aluminium it is more than 60 %. These rates are comparable with some EU Member States.

Source: Bosna-S Consulting, 2006.

Box 6.20 Treatment of electric and electronic waste in Moscow

Moscow's Ecocentre is an advanced treatment facility recycling waste electric and electronic equipment (WEEE) owned by Moscow's municipal government, and a subdivision of the multipurpose waste management company, Promotkhody. In 2003, it added WEEE recycling to its other activities, which include the processing of photographic materials and recovery of precious metals including silver and gold. About 80 % of the waste input is recycled to secondary raw materials such as ferrous, non-ferrous and precious metals, stainless steel, plastics and paper.

The Ecocentre collects the waste in special containers from the Moscow city area within a 100 km radius. The company, with about 50 staff, is operated completely on a market basis, without any subsidies from the state or city. Customer fees paid by waste producers form the basic income of the company. For some categories of waste, Ecocentre pays money for waste received.

Source: Ecocentre, Moscow, 2006.