2.2. Industry

Industry remains an important sector of the economy in Europe and especially in the 12 countries of eastern Europe, the Caucasus and central Asia (EECCA). Industrial output is growing throughout Europe but eco-efficiency is generally improving. Although industrial energy use in western European countries is growing slowly, value added is growing more rapidly, so energy efficiency is improving. In central and eastern Europe, energy efficiency is improving at a faster rate, but remains well below that in western Europe, while industry in EECCA is still seven times more energy intensive than that in the west.

The main challenge in western Europe is to ensure better protection of the environment while maintaining a competitive industrial base. In central and eastern Europe, major investments are needed to raise the environmental performance of industry to the standards required by the accession process. In EECCA, the main challenge is to build an appropriate regulatory framework and improve enforcement.

2.2.1. Introduction

Industry is an important provider of income and employment in many countries in Europe, but is often associated with pollution. However, industrial pollution has decreased substantially over the past 30 years in most western European (WE) countries and over the past 15 years in the central and eastern European (CEE) countries. As industry consists of large and easy identifiable point sources of pollution, it has always been a prime target of environmental policy.

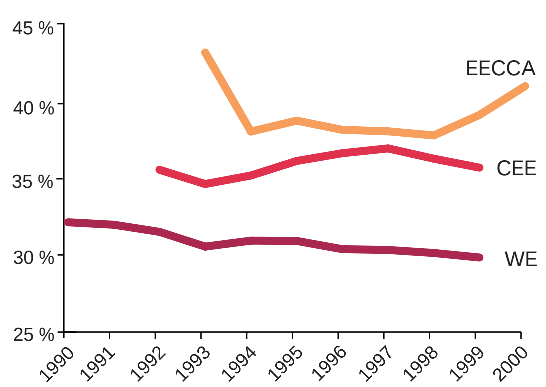
Data on value added and various pollutants specifically for manufacturing industry are generally sparse. In many countries of CEE and eastern Europe, the Caucasus and central Asia (EECCA), data on manufacturing industry still includes electricity production and mining despite guidelines in the national accounting systems that require them to be separated. This is important because industry in these countries is a large auto-producer of electricity and heat, making it difficult to disentangle a company's energy production from its manufacturing activities. The main developments discussed below are therefore for total industry, which includes mining, manufacturing industries and electricity production. Developments in manufacturing industry are then discussed in more detail for those countries for which data are available.

2.2.2. Main socio-economic developments

Throughout the region, total industrial output has been growing again since at least the mid-1990s. Since 1993, total industrial value added has grown by 10 % in WE and 30 % in CEE. The industrial sector in EECCA has only recently started to recover from the decline in the early 1990s, with substantial growth in 1999 and 2000.

Despite growing output, employment in total industry is generally falling — in Poland and the Russian Federation by 32 % and 35 % respectively between 1990 and 1999. Even in the EU, industrial employment fell by 13 % during the same period. However, labour productivity has increased substantially, often by more than the increase in nominal wages. Industry therefore remains a dominant sector in Europe, generating 30-40 % of GDP. In CEE and EECCA, this share remained rather stable during the 1990s, while in WE it slowly diminished (Figure 2.2.1). Remarkable is the growth in CEE economies from 1993 to 1997. This supports the view that the first stage of the transition process was characterised by increased utilisation capacities of industries rather than structural shifts in the economy. Devaluation in CEE countries helped by providing cost advantages for companies in international markets. Only after 1997 did growth in the services sector become more dominant. Such

Share of industry in total GDP, Europe 1990–2000 Figure 2.2.1.



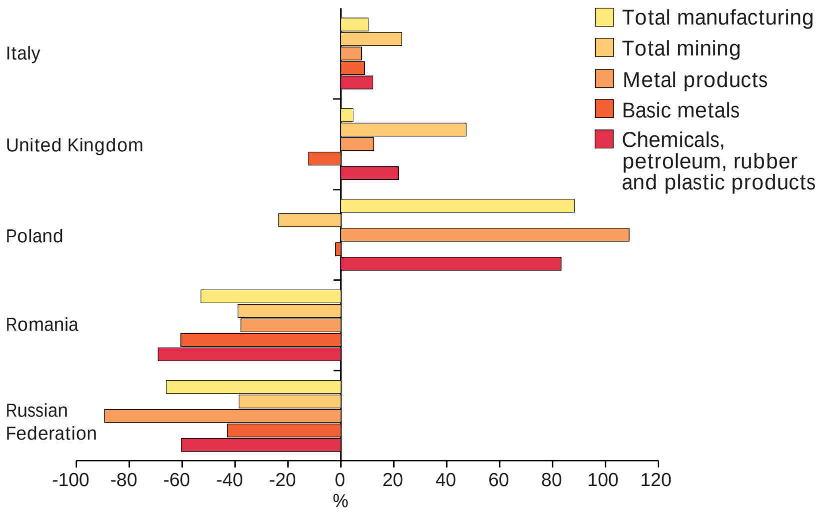
Notes: Data refer to total industry, including mining and electricity production. WE does not include Ireland, Luxembourg, Iceland and Switzerland. CEE does not include Cyprus, Malta, Bosnia-Herzegovina, and Serbia and Montenegro. EECCA does not include Georgia and Tajikistan.

Source: EEA, based on World Bank

developments are still underway in EECCA, where recovery of utilisation capacities only really started in 1999, after the 'rouble crisis' (the 1997 default crisis in the Russian Federation).

The structure of industrial output has changed little in WE but substantially in CEE and EECCA. Figure 2.2.2 shows changes in some energy and pollution-intensive sectors for several large countries in Europe. In Italy and the United Kingdom, growth in relatively polluting activities, such as mining and chemical production, was slightly higher than the overall growth in manufacturing industry. Apparently, such activities have been able to cope quite successfully with the growing competition from CEE and EECCA. In Poland, industry has successfully recovered from the economic crisis, with manufacturing industry producing 80 % more value added than in 1990, and an even higher increase in the metal products industries. This is typical for most of the advanced accession countries. In Hungary, industrial output in the metal product sector in 1999 was nine times that in 1990. However, in Romania and the Russian Federation the situation was markedly different. In the Russian Federation, total manufacturing declined by 70 %, but the food industry and the base-metal sector — especially steel production — have shown signs of recovery in more recent years. Raw steel production in 2000 was nearly at the 1992 level.

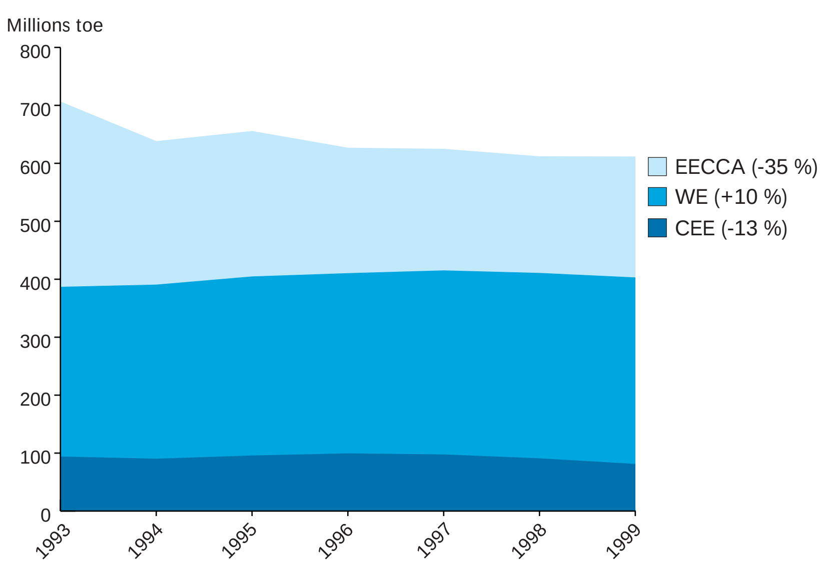
Figure 2.2.2. **Changes in value added of industrial sectors in selected countries, 1990–1999 (%)**



Note: For the Russian Federation, time period is 1990–98.

Source: UN Statistics Division (industrial production index by industry groups)

Figure 2.2.3. **Industrial consumption of energy in Europe, 1993–1999**



Notes: The percentage change between 1993 and 1999 for the three country groupings is given in brackets. Data refer to total industry, including mining and electricity production and do not include transformation losses in refineries and power and heat generation unless taking place within industries or mines.

Source: IEA

2.2.3. Environmental developments

Manufacturing industry is responsible for a wide range of environmental pollution: emissions to air (acidifying substances, greenhouse gases, persistent organic pollutants, heavy metals and other types of pollutants), emissions to water, contamination of soil and the generation of wastes. Moreover, industrial activities are connected to disturbances to landscapes, and the generation of noise and hazards.

Many of the environmental problems of industry are sector specific. Concise and comprehensive data on industrial pollution covering the whole region for the various sectors of industry are virtually non-existent. A few indicators can serve as proxies to indicate overall developments. Industrial energy use is the most often used: it can be seen as a proxy for several important air pollutants (in particular carbon dioxide (CO_2) and to a lesser extent sulphur dioxide (SO_2), nitrogen oxides (NO_X), dioxins and airborne heavy metals).

Industrial energy use declined in the whole region during the 1990s (Figure 2.2.3.). In EECCA, industrial energy use declined by 35 %, mainly because of the fall in industrial output. In CEE countries, there was a small increase in energy use between 1993 and 1996, thereafter energy use declined rapidly. In WE, industrial energy use increased by more than 1 % per year. However, industrial value added in WE countries grew more rapidly than industrial energy use, so energy efficiency continued to improve. Efficiency improvements are most pronounced in the CEE countries — by more than 30 % since 1992. Nevertheless, industry in CEE is still three times more energy intensive than that in WE, and the figure is seven times more in EECCA (Figure 2.2.4.). This is explained partly by the relatively low energy prices prevailing in the former socialist republics.

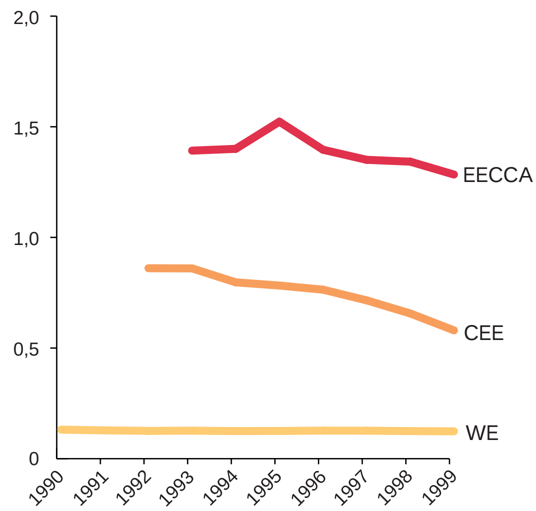
> Industrial energy use during the 1990s fell in central and eastern European, the Caucasus and central Asian countries and grew slowly in western Europe, where energy efficiency continued to improve. Industry in central and eastern Europe is still three times more energy intensive than that in western Europe, and the figure is seven times more in eastern Europe, the Caucasus and central Asia.

The limited data on industrial pollution, water and energy use, only fully available for some countries, show similar, albeit sharper, improvements in eco-efficiency (Figure 2.2.5). On the basis of these limited data, it can be concluded that an absolute decoupling of industrial growth and environmental pressure was achieved for all the chosen indicators in the EU and in Hungary only. Industrial waste generation increased considerably in Poland and in Norway. Water abstraction by industries and emissions of acidifying substances declined in all countries for which data were available. In Slovakia and the Russian Federation, the decline in these pollutants was higher than the reduction in industrial output; in Latvia, the decline was smaller than the decrease in industrial value added.

> Around 75 % of industrial pollution indicators (air emission, water and energy use) show improvement between 1992 and 1999.

The observed decline in some forms of industrial pollution may have different causes for different countries. Some commentators have suggested that economic growth might be the driving force since

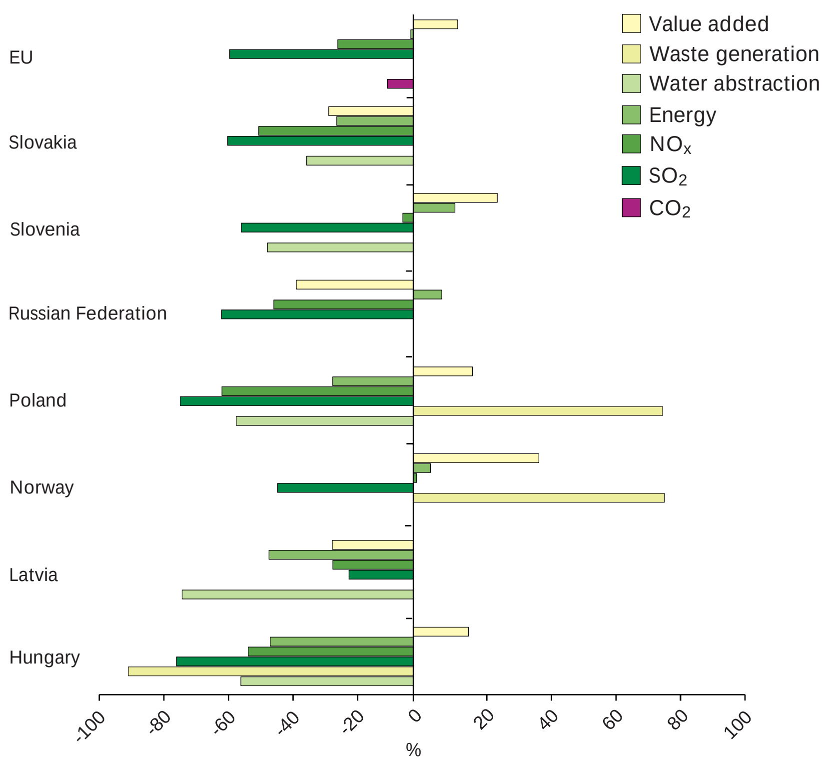
Eco-efficiency in the use of energy in Europe, 1990–1999 — Figure 2.2.4.



Notes: Data refer to total industry, including mining and electricity production. WE does not include Ireland, Luxembourg, Iceland and Switzerland. CEE does not include Cyprus, Malta, Bosnia-Herzegovina and Serbia and Montenegro. EECCA does not include Georgia.

Source: EEA based on World Bank and IEA

Industrial pollution and the input of resources in relation to production growth, EU and selected European countries, 1999 to 1990 — Figure 2.2.5.



Notes: Energy and value added refer to total industry; emissions, water abstraction and waste to manufacturing industry only. Waste is defined as the total amount of primary waste generated by industrial processes. Data of SO_2 and NO_x refer to categories (3) and (4) of SNAP97: combustion processes in manufacturing industries and production processes (which partially includes building activities). For Slovenia and Slovakia, data on SO_2 and NO_x include only combustion processes in manufacturing industries. CO_2 emissions of the EU refer to net emissions (without sinks). All data for Latvia, Slovenia and the Russian Federation refer to 1992-99. All data for Slovakia refer to 1991-99. Water abstraction for Hungary refers to 1992-98 and for Slovenia to 1992-97.

Source: EEA, based on World Bank (value added), IEA (energy), Corinair (SO_2 and NO_x), Eurostat (New Cronos for waste and water abstraction) and EU data on emissions from EEA (Eurostat) higher growth rates allow companies to invest in clean technologies and tend to be associated with a more benign attitude towards environmental policies (Grossman and Krueger, 1995).

Figure 2.2.6 shows that for the industry sector throughout Europe virtually no relationship can be found between the change in SO_2 emissions and the growth in industrial output (measured as value added). However, it appears that for WE countries high industrial growth rates are associated with less reduction in industrial SO_2 emissions in the 1990s.

It is often thought that the transformation in CEE and EECCA countries from heavy industries towards consumer products is responsible for the different relationships as shown in Figure 2.2.6 — industrial structures typically change more rapidly in countries that are experiencing faster growth rates. However, a decomposition analysis into the components of change of SO_2 emission intensities (see Box 2.2.1) reveals that this

Figure 2.2.6. **The change in industrial emissions of sulphur dioxide versus changes in industrial value added, selected European countries, 1999 to 1992**

Notes: For data and definitions see Figure 2.2.5. For Portugal, Ireland and Greece data cover 1992–98, for Ukraine 1992–2000.

Source: EEA, based on World Bank (value added), IEA and Corinair (SO_2)

may not be the case in several countries. It is more likely that higher growth rates allow for more rapid scrapping of out-dated plant, new plant generally having more favourable emission profiles.

2.2.4. Policy outlook

Since the 1970s, much effort at different levels of government has been devoted to controlling industrial pollution. This has resulted in the decoupling of several important pollutants from industrial output. The question is whether such decoupling can be maintained.

A major challenge for industrial pollution control is to improve the cost-effectiveness of environmental regulations in ways that safeguard the environment while maintaining Europe's competitive industrial base. The total cost of environmental protection to manufacturing industry is still only 2 % of industrial value added; however, this figure can be expected to rise. With most relatively inexpensive measures having already been taken in WE, many companies face a steep increase in the marginal costs of further abatement measures. For example, manufacturing industry has, next to households, the highest marginal costs of meeting the Kyoto targets, according to several models (Capros, 1998). Such costs may, however, constitute an opportunity for eco-companies (see Box 2.2.2).

The design of environmental policies has implications for the costs of pollution control. The total costs are determined by the costs of implementing the measures themselves and those of administration, monitoring and enforcement. Virtually nothing is known at present of the magnitude of these costs under different environmental policy arrangements. While simulation studies have reported substantial cost savings from market-based instruments compared to the setting of rigid standards (Tietenberg, 1985), this ignores the fact that industrial regulatory pollution control often mimics cost-equalisation across sectors, for example through the application of the BAT (best available technology) principle. However, application of the BAT principle is not always possible as industry increasingly seeks to abate pollution by complex changes in production processes (i.e. pollution prevention) rather than emission control and waste treatment. This may give rise to an information asymmetry between industries

Box 2.2.1. Components of eco-efficiency improvements in Poland, the Netherlands and Sweden

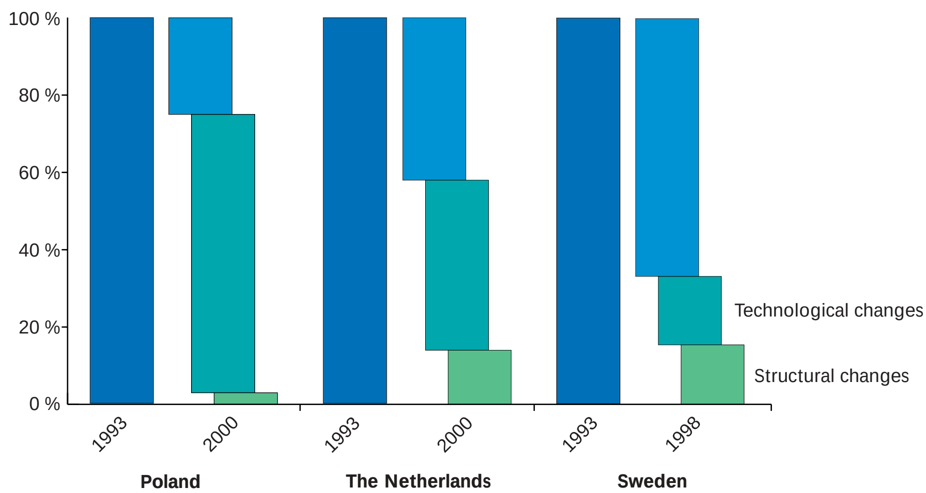
Improvements in the eco-efficiency of manufacturing industry can result from structural changes (the shift towards less pollution-intensive activities) and from technological changes (cleaner technology, end-of-pipe measures or changes in the input mix of raw materials).

Figure 2.2.7 shows the effects of such changes on SO_2 emission intensities for Poland, the Netherlands and Sweden. In all countries, manufacturing emissions of SO_2 declined considerably between 1993 and 2000 (1998 for Sweden), resulting in improvements in emission intensities of 38 % in Sweden, 72 % in the Netherlands and 75 % in Poland. Structural changes contributed to a decline in emissions in the Netherlands and Sweden but hardly at all in Poland. Although there were many structural shifts in the Polish economy, the net effect on the environment was small, as the decline in base metal and refinery industries was offset by substantial increases in the production of chemicals and metal products. The structural changes in the Netherlands are explained by the relatively low growth in value added from refineries during the period. Other polluting sectors, such as the chemical industries, were growing faster than average. In Sweden, the relative importance of structural changes for the total reduction of emissions is explained mainly by the substantial growth in the relatively clean production of communication equipment.

Technological change seemed to be most dominant in Poland, where emissions declined by 72 % as a result of technological changes. This suggests that environmental policy, which stimulates the application of clean technology, and a higher rate of capital scrapping have been mainly responsible for the reduction of SO_2 emissions in Poland. In the Netherlands, technological changes contributed 43 % of the decline in emission intensities. Technological improvements in Swedish heavy industries were relatively poor between 1993 and 1998.

Sulphur dioxide emission intensities in Poland, the Netherlands (1993–2000) and Sweden (1993–98)

Figure 2.2.7.



Notes and **sources**: The components of the decline in emission intensities have been identified with decomposition analysis (Ang, 1994). SO_2 emissions for manufacturing industry only (NACE 15–37). Data for Poland from national statistical office (GUS). Data on SO_2 refer to the main polluters that are obliged to register their pollution. Together they constitute approximately 80 % of total pollution. Data for the Netherlands derived from national statistical office (CBS) using NAMEA statistics. Data for Sweden obtained from national statistical office (SCB). The emission intensities of all sectors have been calculated using sector-specific deflated value-added data. Calculations conducted by CE consulting using the proportional decomposition method, as described in De Bruyn (2000).

and the regulator, which normally involves substantial administration costs to be balanced. Compared with 1994, the share of capital investments in total environmental expenditures has fallen, indicating that more efforts are now devoted to operating costs and to research and development (Ecotec, 2002). This could be a sign of the growing complexity of industrial pollution regulations in WE.

A primary obstacle to the implementation of tighter environmental policy measures is the fear of reduced international competitiveness in pollution-intensive sectors. Although a number of empirical studies (Mulatu *et al.*, 2002) have indicated that the adverse effects of environmental expenditures on competitiveness are small or even absent, many environmental policy plans have special arrangements for

Box 2.2.2. Environmental expenditures and eco-companies — an opportunity

Industry not only contributes to environmental pollution, it also helps to solve environmental problems. 'Eco-industry' is the bundle of activities that produce goods and services (such as consultancy activities) that measure, prevent, limit, minimise or correct environmental damage.

The added value of eco-companies in the EU has risen almost threefold during the past five years (from EUR 35 billion in 1994 to EUR 98 billion in 1999). Around 2.3 % of GDP was generated by eco-companies, suggesting that the importance of eco-companies for income generation is similar to, for example, the base-metal sector in WE economies. Direct employment in the EU in eco-companies amounts to more than 2 million (full-time equivalent) jobs.

Total expenditure on environmental management and protection has increased by 5 % annually since 1994 and reached EUR 183 billion in 1999. Most of the expenditure relates to wastewater treatment and the management of solid waste. In the near future the market for clean technologies is expected to increase further, especially because of the production of equipment for renewable energy plants to meet the EU's Kyoto protocol targets.

In the accession countries, the environmental body of EU law is the main reason for pollution investments. The emphasis is on wastewater measures and end-of-pipe measures for air pollution.

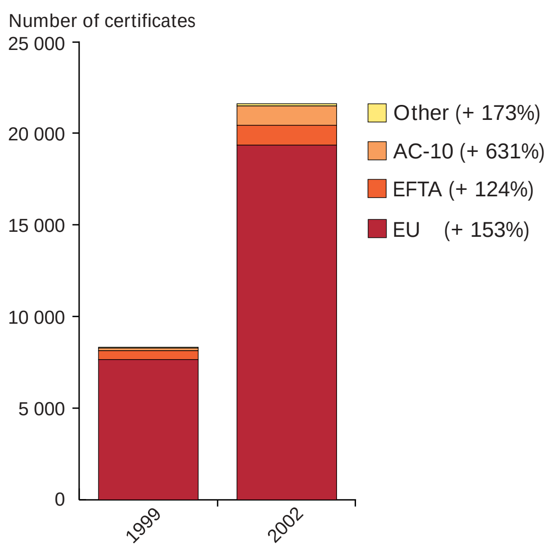
Source: European Commission

Box 2.2.3. Environmental management systems are becoming increasingly popular

The number of environmental management systems (EMS) in Europe grew by 160 % between 1999 and 2002. There are two main systems: the ISO 14001 standards adopted worldwide, and the eco-management and audit scheme (EMAS) which has been set up by the EU. Nearly 40 000 certificates have been issued worldwide: around 36 000 ISO 14001 and nearly 4 000 EMAS. The EU accounts for almost 50 % of these certificates worldwide. Most remarkable is the spectacular growth in ISO 14001 certificates in the accession countries — a sixfold increase since 1999.

The main reason for installing ISO 14001 or EMAS in companies is to achieve better relationships with regulators and clients. They are therefore important marketing tools and help in negotiations with governments on environmental regulations. The total administrative effort (for companies and society) in applying and running a typical company EMAS is between 0.7 and 1.2 person-months of work per year (Lulofs, 2000). Around 20 % of the costs are borne by the companies. Many small companies apply ISO 14001 or EMAS rules without actual certification because of the costs involved. Their numbers are not included in Figure 2.2.8.

Figure 2.2.8. **Development in the application of EMS in Europe**



Notes: Application of EMS involves both ISO 14001 and EMAS. 1999 refers to the number of certificates in June 1999. 2002 refers to the certificates in January 2002. The figures in brackets next to the keys give the growth in the number of certificates between 1999 and 2002.

Sources: Gergely Tóth, Hungarian Association of Environmentally Aware Businesses (KÖVET-INEM Hungária) and the EMAS Helpdesk, Brussels

pollution-intensive industries. For example, the OECD/EU database on environmental taxes shows that environmentally related taxes are levied almost exclusively on households and the transport sector. Exemptions and rebates for the industrial sector undermine the application of the polluter pays principle and result in less than optimal pollution control because abatement measures are not directed at the areas where they are likely to have the greatest overall effect.

Industry itself tends to have a preference for voluntary approaches, as indicated by a recent survey in the Netherlands (Blok *et al.*, 2001). Environmental management systems (see Box 2.2.3) and environmental and social reporting are important instruments here. However, the total effect on the environment of voluntary approaches is often unknown and difficult to estimate (Starzer, 2001).

The number of environmental management systems in Europe grew significantly between 1999 and 2002.

For CEE countries, accession may continue to be the main driving force for environmental policy initiatives in the coming years. Manufacturing industry in CEE countries faces difficult tasks in the accession procedure. The expected effects of accession include increased competition from lowered tariffs, fewer subsidies, cost pressures from rising real wages and, most likely, an appreciating real exchange rate. In addition, substantial costs can be expected from the implementation of the full Community body of EU law (regulation and policies), of which the environmental legislation will be the most costly for the manufacturing and energy production industries (see Box 2.2.4).

The adaptation of current environmental legislation to the body of EU law poses some additional challenges for accession countries. Environmental policy in most countries currently relies more on economic instruments than in EU countries. Figure 2.2.9 gives an overview of the revenues from economic instruments for environmental protection related to industrial value added in some accession countries and compares them with the EU. While initially fees and fines were too low to act as incentives, substantial increases during the1990s had some effects. Especially in the Czech Republic and Poland, abatement is now often more attractive for companies than paying fines. The revenues from such taxes are earmarked for environmental protection and nature conservation.

The legal approach to transposing and implementing EU legislation carries the risk that the current system of environmental taxes will be replaced by the regulatory framework of the EU without any discussion of the effectiveness of such a tax and fund-raising system in accession countries. Mutually agreed reduction targets may bring the environmental performance of industry more in line with the EU, without necessarily affecting present legislation. Since energy taxes are still fairly low compared with those in WE, an alternative is a gradual switch from pollution taxation towards energy taxation.

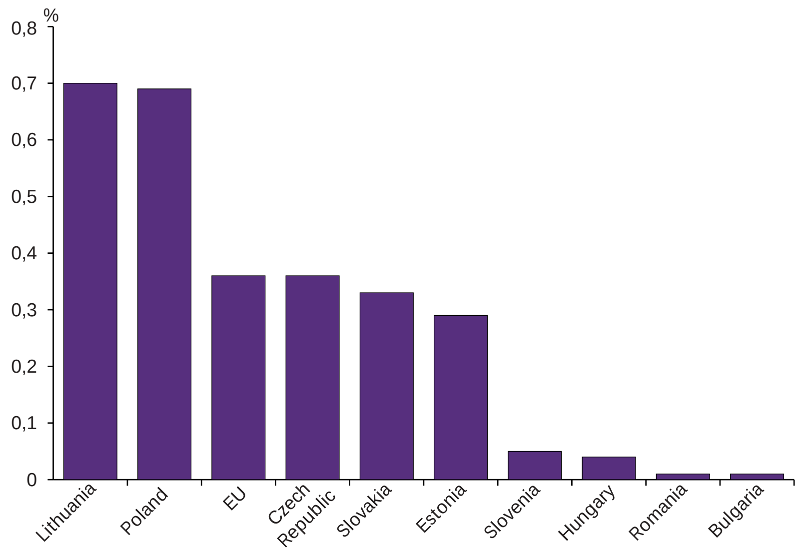
In EECCA, the main challenge is to build up legal capacities. Building an appropriate regulatory framework and improved enforcement is crucial here and timing is essential. Current industrial environmental policies in EECCA have evolved mainly around emission limit values laid down in permits. Non-compliance triggers a fine, which is, however, relatively low. Procedures are cumbersome and administrative costs may be greater than the fines. Many companies are therefore permanently in non-compliance. The economy has improved during the past two years, and it is essential that environmental policy now catches up. Increases in fines and taxes for pollution and improved enforcement capacities may be the most straightforward way to guarantee that environmental pollution will develop in similar ways to those observed in CEE countries.

Box 2.2.4. Costs and benefits from EU accession

The total investment needed to meet the EU environmental directives is estimated to be roughly EUR 120 billion, or 32 % of current GDP of the 10 central and eastern European accession countries (Orlowski and Mayhew, 2001). When spread over 20 years such costs will require an annual investment of around 1.5 % of current GDP. Additionally, operating costs may require another 2.5 % of GDP annually. The expenditure on implementation of the air pollution directives will take around 40 % of these costs and mostly be borne by industry and the energy production sector.

The environmental body of EU law will also contribute to benefits: improved health and better environmental services. The benefits of compliance with the environmental body of EU law are estimated to range from EUR 134 to EUR 681 billion (Ecotec et al., 2001), the range being typical of the uncertainties associated with benefit analysis. The major source of these benefits will be industrial pollution control. However, the benefits will arise in the long term and be partly intangible, while the costs are to be borne now. Moreover, benefits do not accrue directly to industry but to society as a whole.

Revenues from economic instruments for environmental protection in % of industrial value added, EU and selected European countries, 1997 — Figure 2.2.9.



Note: Data refer to pollution charges, fines and taxes only and not to input-related taxes such as energy or motor fuel taxes. Data for Romania refer to 1996.

Sources: REC, 1999; Eurostat, 2000

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